

Title: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING
AND EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM
COMPONENTS

Inventor: Bond, et al; Serial No.: 09/900,522; filed 7/6/01
Atty. Ref. No.: 7784-000260; Harness Dickey & Pierce (248) 641-1600

1/87

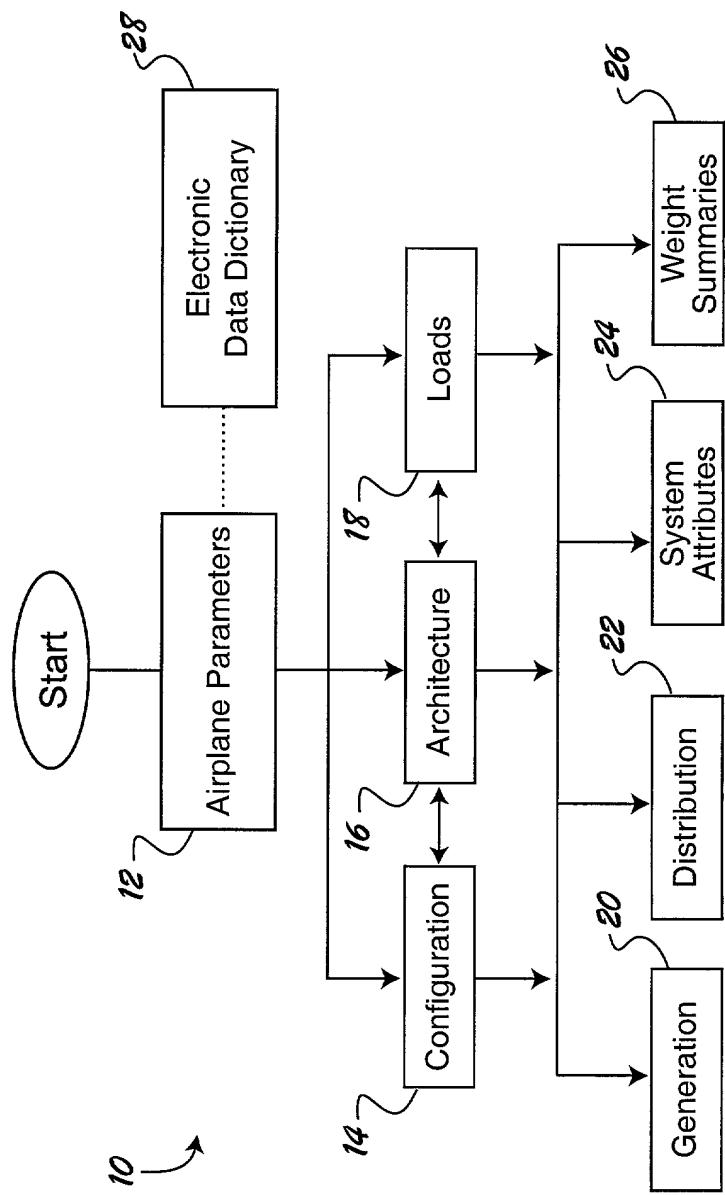
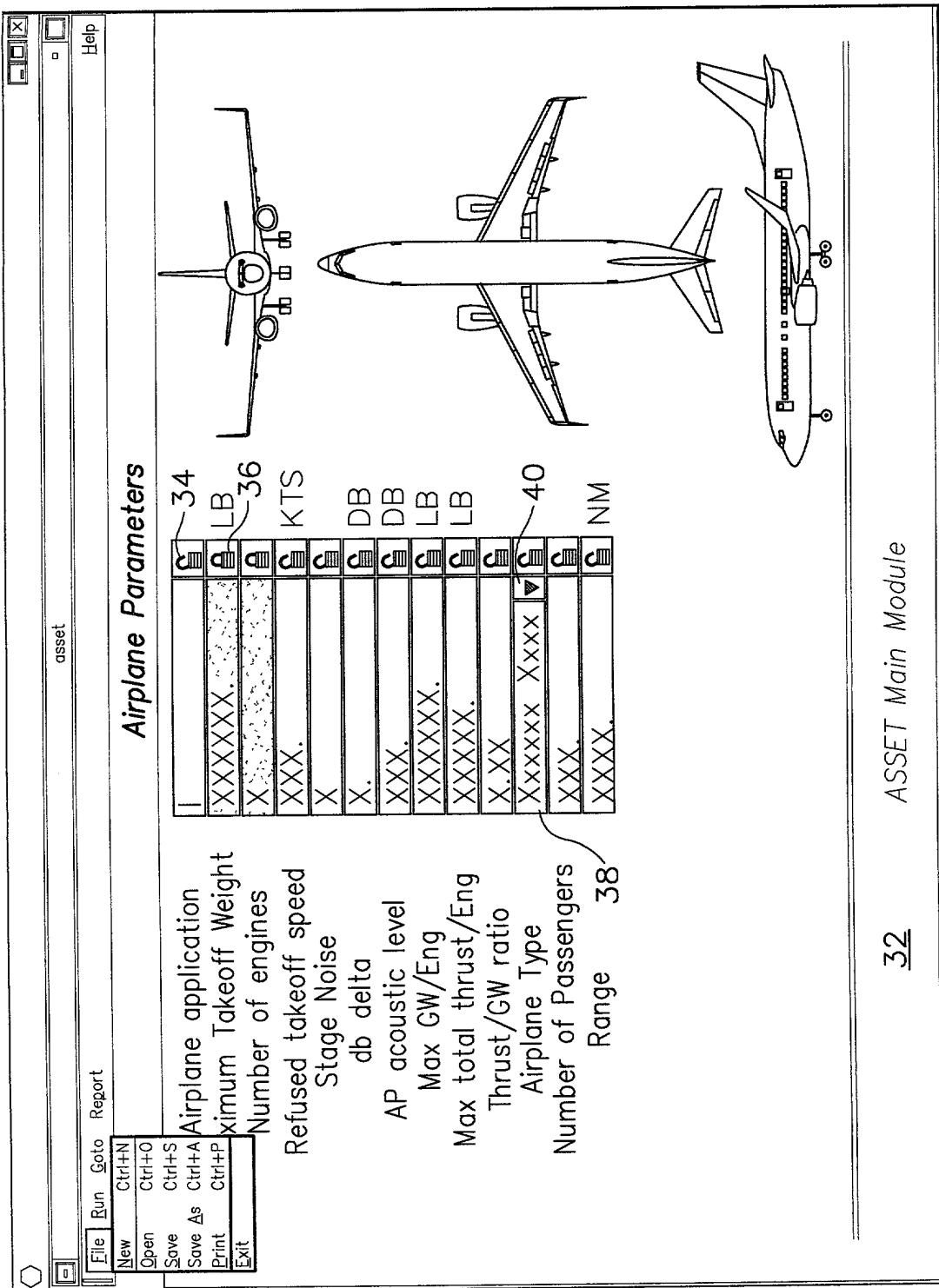


FIG. 1



32 ASSET Main Module

FIG. 2

asset

Help

File Run Goto Report
Calculate Optimize 42

Airplane Parameters

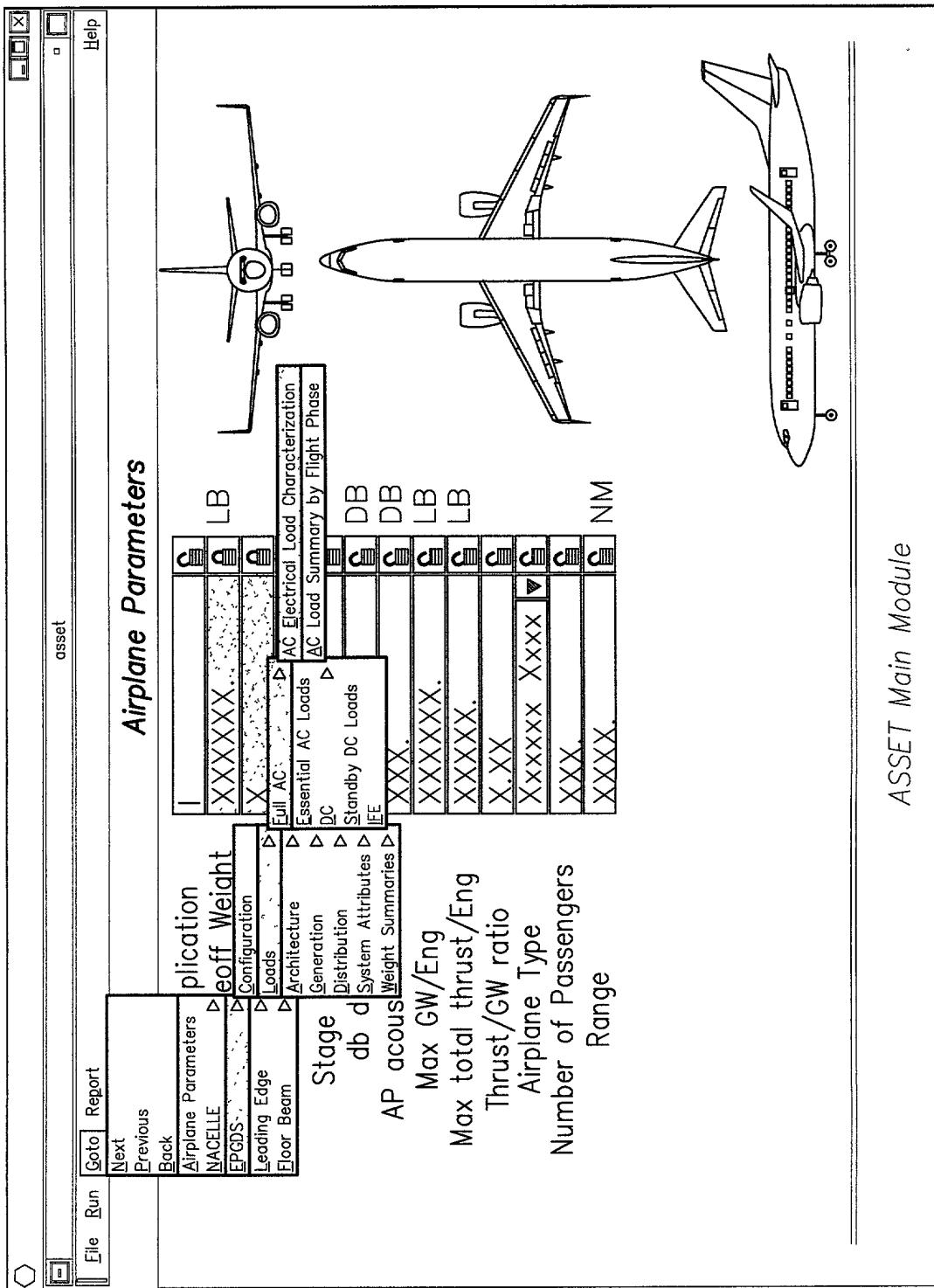
44 Airplane application

| | |
|------------------------|-----|
| Maximum Takeoff Weight | LB |
| Number of engines | KTS |
| Refused takeoff speed | DB |
| Stage Noise | DB |
| db delta | LB |
| AP acoustic level | LB |
| Max GW/Eng | LB |
| Max total thrust/Eng | NM |
| Thrust/GW ratio | |
| Airplane Type | |
| Number of Passengers | |
| Range | |

32

ASSET Main Module

FIG. 3



ASSET Main Module

FIG. 4

ASSET Configuration

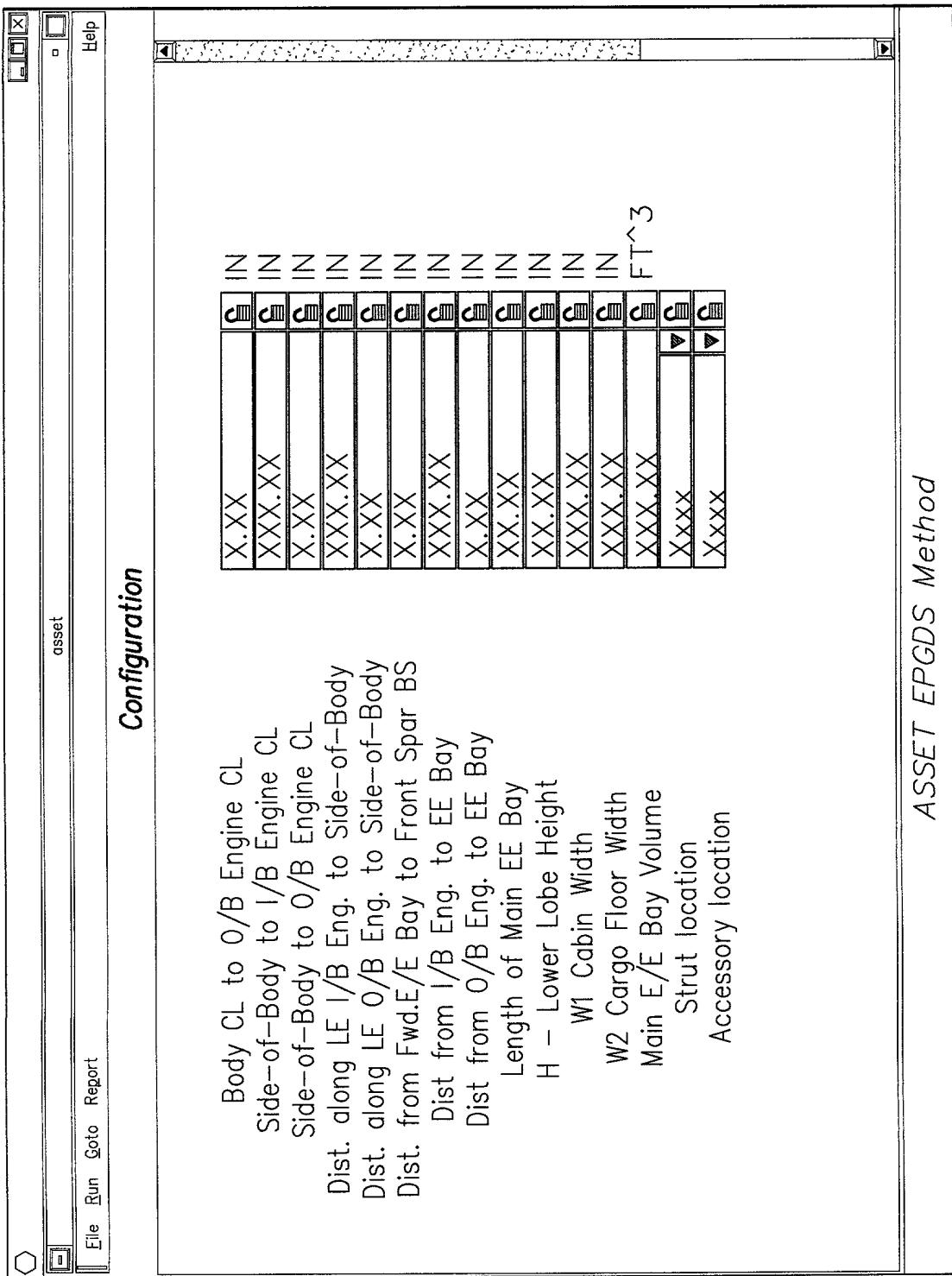
General:

48a 48 50

| | |
|--------------------------------------|------------------------------------------|
| Fly-by-Wire | <input checked="" type="checkbox"/> TRUE |
| Frequency Type | Xxxxxxx |
| Dual EE Bay | <input type="checkbox"/> FALSE |
| Double Voltage | <input type="checkbox"/> FALSE |
| RAT Generator? | <input checked="" type="checkbox"/> TRUE |
| Technology Era | Xxxxxxx |
| Fuselage Length | XXX.XXX |
| Fuselage Diameter | XXX.XX |
| Number of Passenger Entry/Exit Doors | X |
| Number of External Power Panels | XXX.XXX |
| Fan Diameter | XXX.XXX |
| Sweep Angle | XXXXXX |
| Wing Span | XXX.XXX |
| Horizontal Tail Span | NN |
| | DEG |

ASSET EPGDS Method

FIG. 5A



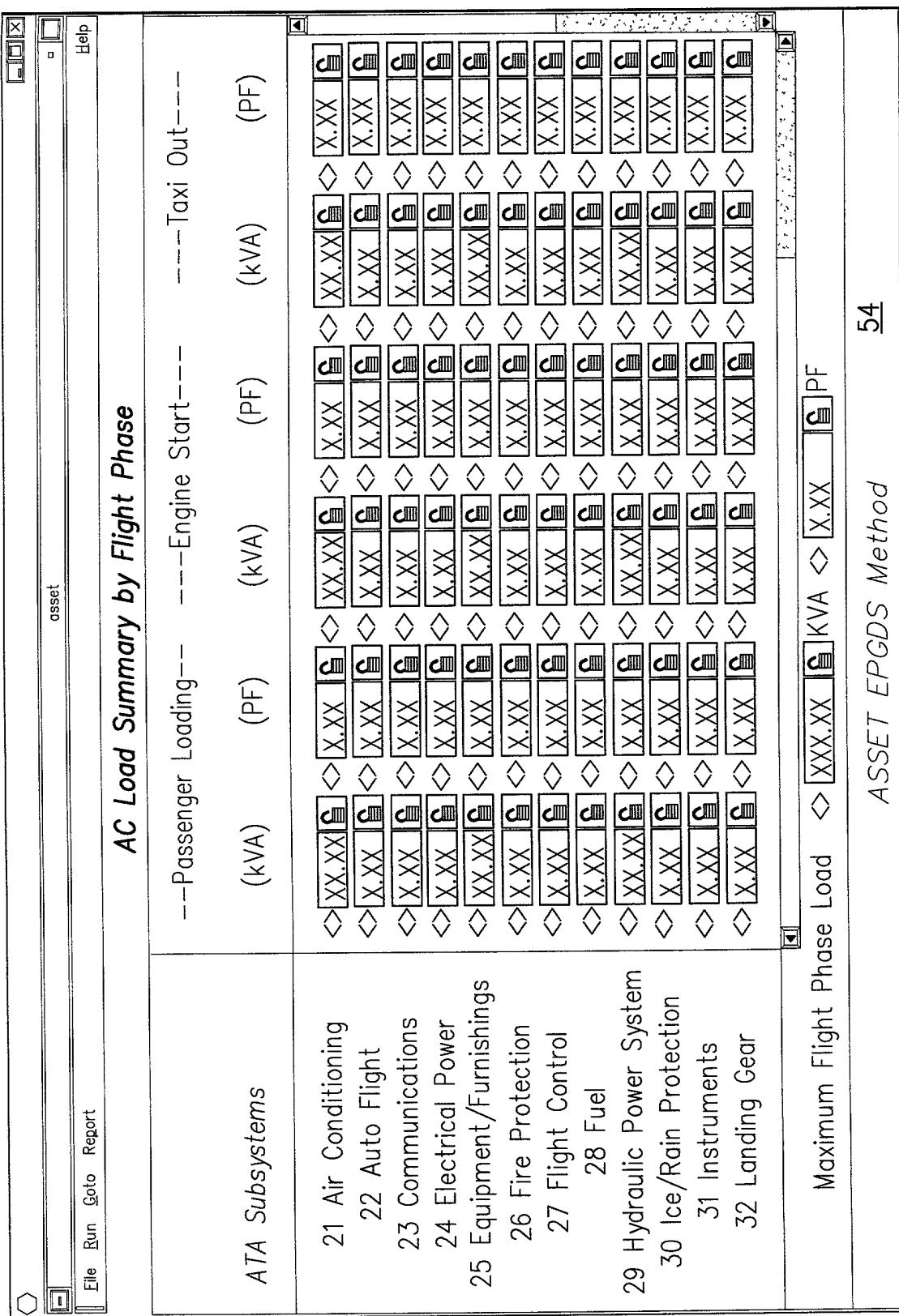
ASSET EPCDS Method

FIG. 5B

7 / 87

| AC Electrical Load Characterization | |
|--------------------------------------|-------------------------------------|
| Number of Fans | <input type="checkbox"/> |
| Recirculation Fans | <input type="checkbox"/> |
| Number of E/E Cooling Vent Fans | <input type="checkbox"/> |
| Number of E/E Cooling Supply Fans | <input type="checkbox"/> |
| Number of TRUs | <input type="checkbox"/> |
| Number of ACMPs | <input type="checkbox"/> |
| Number of Window/Windshield Heaters | <input type="checkbox"/> |
| Number of Lavatories | <input type="checkbox"/> |
| | |
| Number of Wide Body Pumps | <input checked="" type="checkbox"/> |
| Number of Wide Body Boost Pumps | <input type="checkbox"/> |
| Number of Wide Body Override Pumps | <input type="checkbox"/> |
| Number of Wide Body Jettison Pumps | <input type="checkbox"/> |
| | |
| Number of Narrow Body Pumps | <input type="checkbox"/> |
| Number of Narrow Body Boost Pumps | <input type="checkbox"/> |
| Number of Narrow Body Override Pumps | <input type="checkbox"/> |
| Number of Narrow Body Jettison Pumps | <input type="checkbox"/> |

6
FIG.



The screenshot shows a software window titled "ASSET EPGDS Method". On the left, there's a menu bar with "File", "Run", "Goto", and "Report". Below the menu is a toolbar with icons for "New", "Open", "Save", "Print", and "Help". The main area contains a table titled "AC Load Summary by Flight Phase". The columns are labeled "ATA Subsystems", "(kVA)", "(PF)", "(kVA)", "(PF)", and "(PF)". The rows list various aircraft systems. The table is filled with placeholder values like "X.XX" and "X.XXX". At the bottom of the table, there's a note: "Maximum Flight Phase Load <> XXX.XX kVA <> X.XX PF".

| ATA Subsystems | (kVA) | (PF) | (kVA) | (PF) | (PF) |
|---------------------------|----------|--------|-------------------|--------|---------------|
| --Passenger Loading-- | | | --Engine Start--- | | --Taxi Out--- |
| 21 Air Conditioning | <>XXX.XX | <>X.XX | <>XXX.XX | <>X.XX | <>XXX.XX |
| 22 Auto Flight | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |
| 23 Communications | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |
| 24 Electrical Power | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |
| 25 Equipment/Furnishings | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | <>XX.XX |
| 26 Fire Protection | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |
| 27 Flight Control | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |
| 28 Fuel | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |
| 29 Hydraulic Power System | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | <>XX.XX |
| 30 Ice/Rain Protection | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |
| 31 Instruments | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |
| 32 Landing Gear | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX |

FIG. 7A

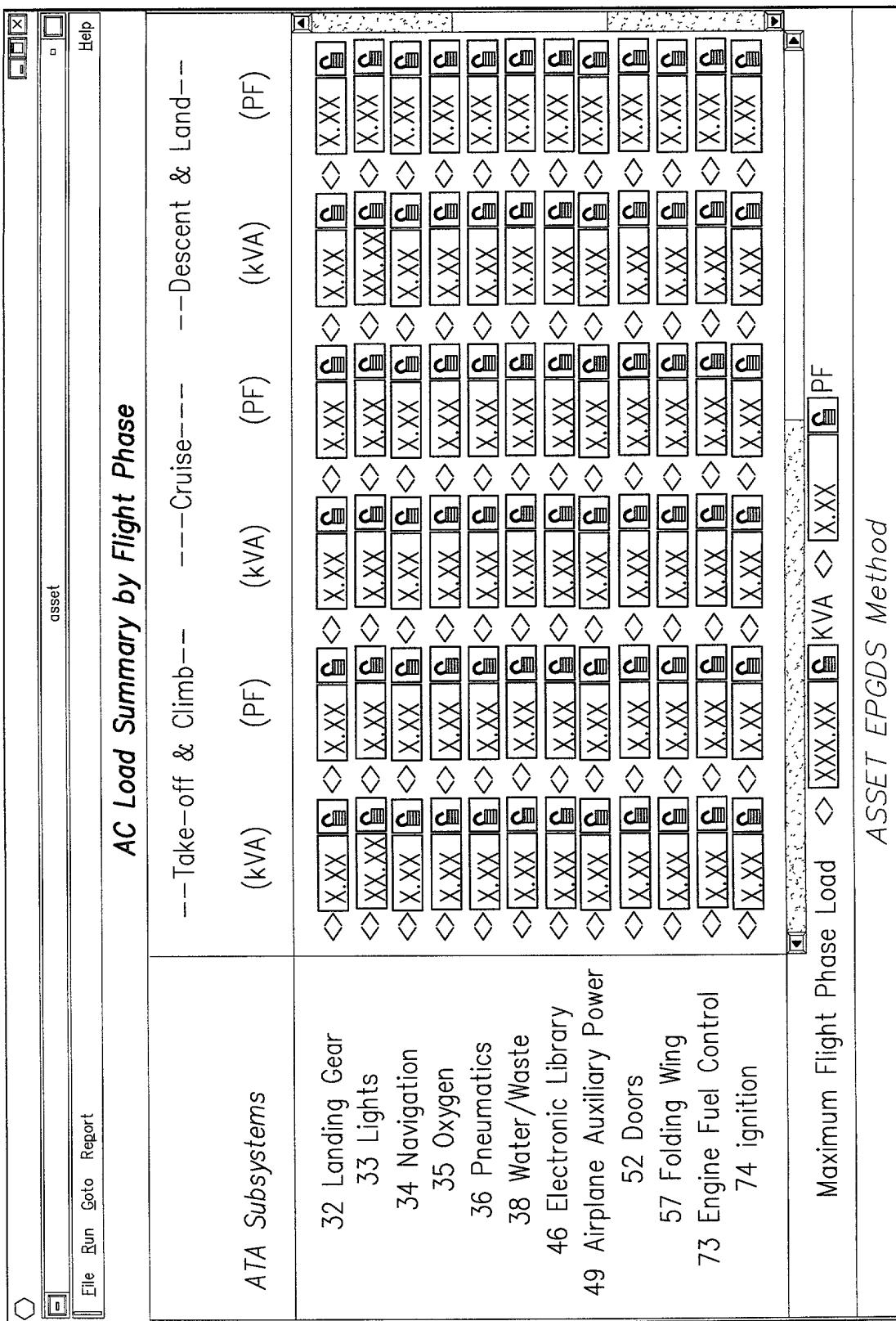
ASSET EPGDS Method

54

9 / 87

| ATA Subsystems | AC Load Summary by Flight Phase | | |
|-----------------------------|---------------------------------|------------------|---------------|
| | --Passenger Loading-- | --Engine Start-- | --Taxi Out--- |
| | (kVA) | (kVA) | (kVA) |
| 32 Landing Gear | < X.XX | < X.XX | < X.XX |
| 33 Lights | < XXX.XX | < X.XX | < X.XX |
| 34 Navigation | < X.XX | < X.XX | < X.XX |
| 35 Oxygen | < X.XX | < X.XX | < X.XX |
| 36 Pneumatics | < X.XX | < X.XX | < X.XX |
| 38 Water/Waste | < X.XX | < X.XX | < X.XX |
| 46 Electronic Library | < X.XX | < X.XX | < X.XX |
| 48 Airplane Auxiliary Power | < X.XX | < X.XX | < X.XX |
| 52 Doors | < X.XX | < X.XX | < X.XX |
| 57 Folding Wing | < X.XX | < X.XX | < X.XX |
| 73 Engine Fuel Control | < X.XX | < X.XX | < X.XX |
| 74 Ignition | < X.XX | < X.XX | < X.XX |
| Maximum Flight Phase Load | < XXX.XX | < KVA | < PF |

FIG. 7B



The screenshot shows a software application window titled "ASSET EPGDS Method". The main area displays a table titled "AC Load Summary by Flight Phase". The table has columns for "ATA Subsystems", "---Take-off & Climb---", "----Cruise----", "---Descent & Land---", "(kVA)", "(PF)", "(kVA)", "(PF)", and "(kVA)".

| ATA Subsystems | ---Take-off & Climb--- | ----Cruise---- | ---Descent & Land--- | (kVA) | (PF) | (kVA) | (PF) | (kVA) |
|-----------------------------|------------------------|----------------|----------------------|------------|------------|------------|------------|------------|
| 32 Landing Gear | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 33 Lights | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 34 Navigation | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 35 Oxygen | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 36 Pneumatics | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 38 Water/Waste | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 46 Electronic Library | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 49 Airplane Auxiliary Power | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 52 Doors | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 57 Folding Wing | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 73 Engine Fuel Control | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |
| 74 Ignition | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G | ◇ X.XX G |

At the bottom of the table, there is a note: "Maximum Flight Phase Load ◇ XXX.XX | G KVA ◇ X.XX | G PF".

FIG. 7C

11/87

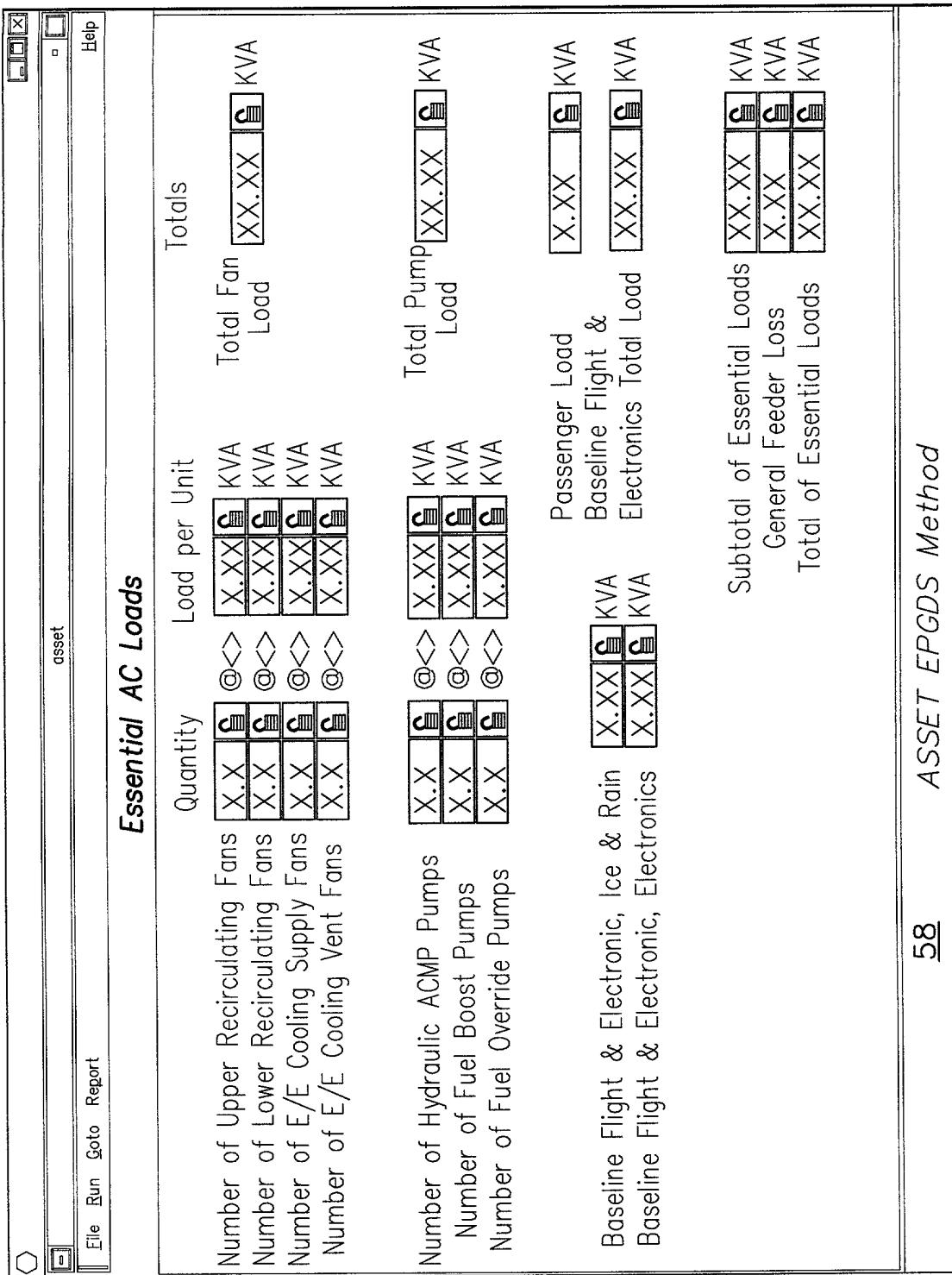
AC Load Summary by Flight Phase

| ATA Subsystems | Take-off & Climb-- | | | Cruise--- | | | Descent & Land-- | | |
|---------------------------|--------------------|--------|----------|-----------|----------|--------|------------------|--------|--|
| | (kVA) | (PF) | (kVA) | (PF) | (kVA) | (PF) | (kVA) | (PF) | |
| 73 Engine Fuel Control | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | |
| 74 Ignition | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | |
| 75 Air | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | |
| 76 Engine Controls | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | |
| 77 Engine Indicating | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | |
| 78 Exhaust | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | |
| 79 Oil | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | |
| 80 Starting | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | <>X.XX | |
| Flight Phase Subtotals | <>XXX.XX | <>X.XX | <>XXX.XX | <>X.XX | <>XXX.XX | <>X.XX | <>XXX.XX | <>X.XX | |
| Error/Growth Factor(15%) | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | <>XX.XX | <>X.XX | |
| Flight Phase Totals | <>XXX.XX | <>X.XX | <>XXX.XX | <>X.XX | <>XXX.XX | <>X.XX | <>XXX.XX | <>X.XX | |
| Maximum Flight Phase Load | <>XXX.XX | <>X.XX | <>KVA | <>X.XX | <>PF | | | | |

ASSET EPGDS Method

FIG. 7D

12/87



The screenshot shows a software application window titled "ASSET EPGDS Method". The menu bar includes "File", "Run", "Goto", "Report", and "Help". A toolbar on the left contains icons for "New", "Open", "Save", "Print", and "Exit". The main area is titled "Essential AC Loads" and displays a table of load data.

| | Quantity | Load per Unit | | | Totals | | |
|-------------------------------------------|----------|---------------|------|-----|------------------------------------------|--------|-----|
| Number of Upper Recirculating Fans | X.X | @<> | X.XX | KVA | Total Fan Load | XXX.XX | KVA |
| Number of Lower Recirculating Fans | X.X | @<> | X.XX | KVA | | | |
| Number of E/E Cooling Supply Fans | X.X | @<> | X.XX | KVA | | | |
| Number of E/E Cooling Vent Fans | X.X | @<> | X.XX | KVA | | | |
| | | | | | | | |
| Number of Hydraulic ACMP Pumps | X.X | @<> | X.XX | KVA | Total Pump Load | XXX.XX | KVA |
| Number of Fuel Boost Pumps | X.X | @<> | X.XX | KVA | | | |
| Number of Fuel Override Pumps | X.X | @<> | X.XX | KVA | | | |
| | | | | | | | |
| Baseline Flight & Electronic, Ice & Rain | X.XX | KVA | | | Passenger Load | X.XX | KVA |
| Baseline Flight & Electronic, Electronics | X.XX | KVA | | | Baseline Flight & Electronics Total Load | XXX.XX | KVA |
| | | | | | | | |
| Subtotal of Essential Loads | XXX.XX | KVA | | | | | |
| General Feeder Loss | X.XX | KVA | | | | | |
| Total of Essential Loads | XXX.XX | KVA | | | | | |

FIG. 8

58 ASSET EPGDS Method

13/87

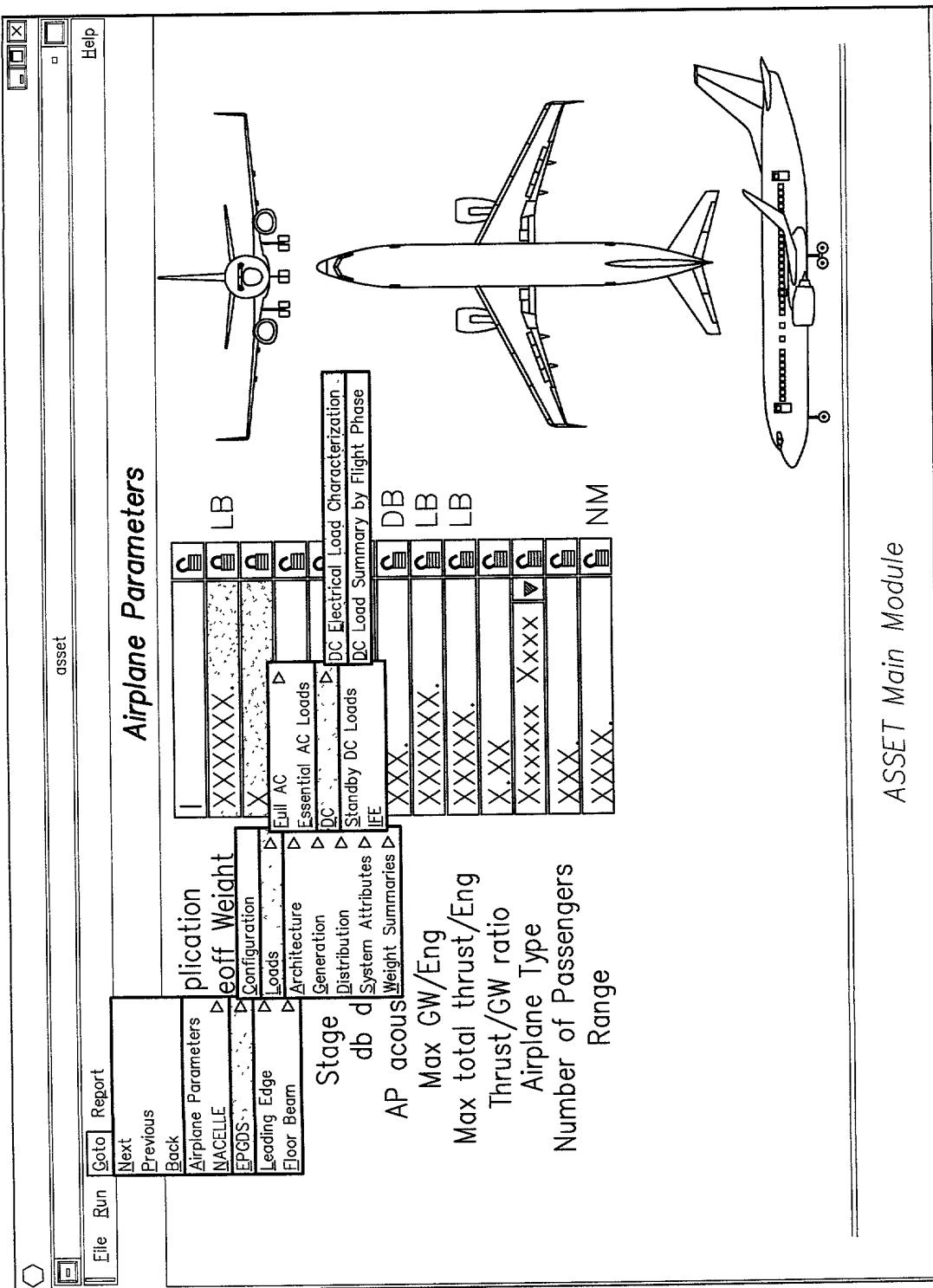


FIG. 9

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS
INVENTOR: BOND, et al.
SN: 09/900,522; FILED 7/6/01
ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

14/87

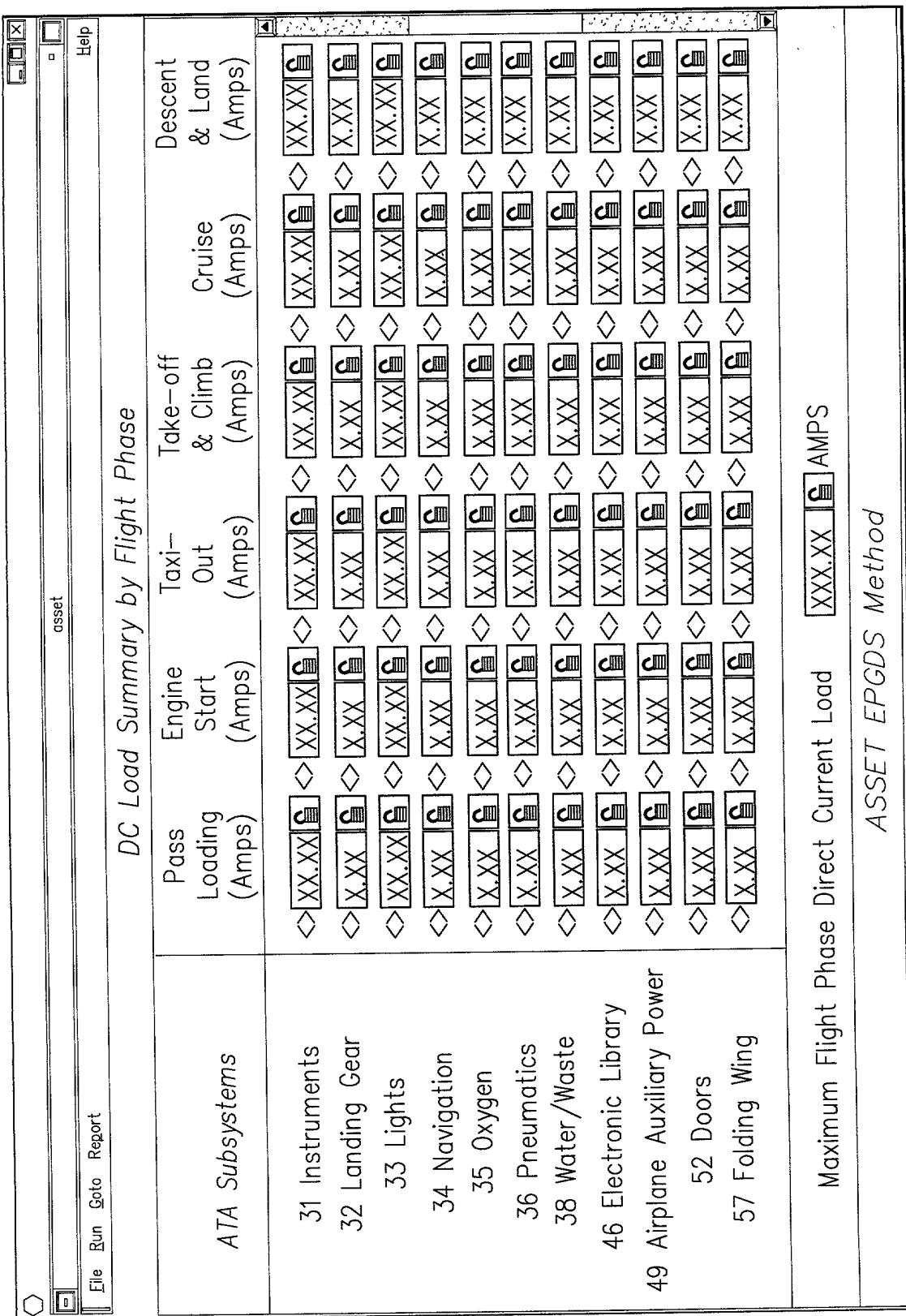
The screenshot shows a software application window titled "ASSET EPGDS Method". On the left, there is a vertical toolbar with icons for "asset", "Run", "Goto", and "Report". Below this is a menu bar with "File", "Run", "Goto", and "Report". The main area contains a report titled "DC Electrical Load Characterization". The report includes a table with the following data:

| | Number of Main Landing Gear Wheels | Number of APU Generators | Number of Doors | Number of Tanks |
|--|------------------------------------|--------------------------|-----------------|-----------------|
| | X.X | C | C | C |
| | X.X | C | C | C |
| | X.X | C | C | C |
| | X.X | C | C | C |

On the right side of the report, there is a vertical column of text: "ASSET EPGDS Method".

FIG. 10

FIG. 11 A



The screenshot shows a software window titled "DC Load Summary by Flight Phase". The menu bar includes "File", "Run", "Goto", "Report", "asset", and "Help". The table has columns for ATA Subsystems, Pass Loading (Amps), Engine Start (Amps), Taxi-Out (Amps), Take-off & Climb (Amps), Cruise (Amps), and Descent & Land (Amps). The ATA Subsystems listed are 31 Instruments, 32 Landing Gear, 33 Lights, 34 Navigation, 35 Oxygen, 36 Pneumatics, 38 Water/Waste, 46 Electronic Library, 49 Airplane Auxiliary Power, 52 Doors, and 57 Folding Wing. Each subsystem row contains seven cells, each containing a placeholder value like "XXX.XXX" followed by a circled letter.

| ATA Subsystems | Pass Loading (Amps) | Engine Start (Amps) | Taxi-Out (Amps) | Take-off & Climb (Amps) | Cruise (Amps) | Descent & Land (Amps) |
|------------------------------------------|---------------------|---------------------|-----------------|-------------------------|---------------|-----------------------|
| 31 Instruments | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 32 Landing Gear | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 33 Lights | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 34 Navigation | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 35 Oxygen | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 36 Pneumatics | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 38 Water/Waste | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 46 Electronic Library | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 49 Airplane Auxiliary Power | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 52 Doors | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| 57 Folding Wing | <>XXX.XXX [A] | <>XXX.XXX [B] | <>XXX.XXX [C] | <>XXX.XXX [D] | <>XXX.XXX [E] | <>XXX.XXX [F] |
| Maximum Flight Phase Direct Current Load | | | | | | |
| ASSET EPGDS Method | | | | | | |
| XXX.XX [A] AMPS | | | | | | |

FIG. 11B

17/87

DC Load Summary by Flight Phase

| ATA Subsystems | Pass Loading (Amps) | Engine Start (Amps) | Taxi-Out (Amps) | & Climb (Amps) | Take-off & Cruise (Amps) | (Amps) | Descent & Land (Amps) |
|------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------|-----------------|----------------|--------------------------|--------|-----------------------|
| 52 Doors | <>X.XX █ | | | | | | |
| 57 Folding Wing | <>X.XX █ | | | | | | |
| 73 Engine Fuel Control | <>X.XX █ | | | | | | |
| 74 Ignition | <>X.XX █ | | | | | | |
| 75 Air | <>X.XX █ | | | | | | |
| 76 Engine Controls | <>X.XX █ | | | | | | |
| 77 Engine Indicating | <>X.XX █ | | | | | | |
| 78 Exhaust | <>X.XX █ | | | | | | |
| 79 Oil | <>X.XX █ | | | | | | |
| 80 Starting | <>X.XX █ | | | | | | |
| Flight Phase Totals | <>XXX.XX █ <>XXX.XX █ | | | | | | |
| Maximum Flight Phase Direct Current Load | | | | | XXX.XX █ AMPS | | |
| ASSET EPGDS Method | | | | | | | |

FIG. 11C

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

18/87

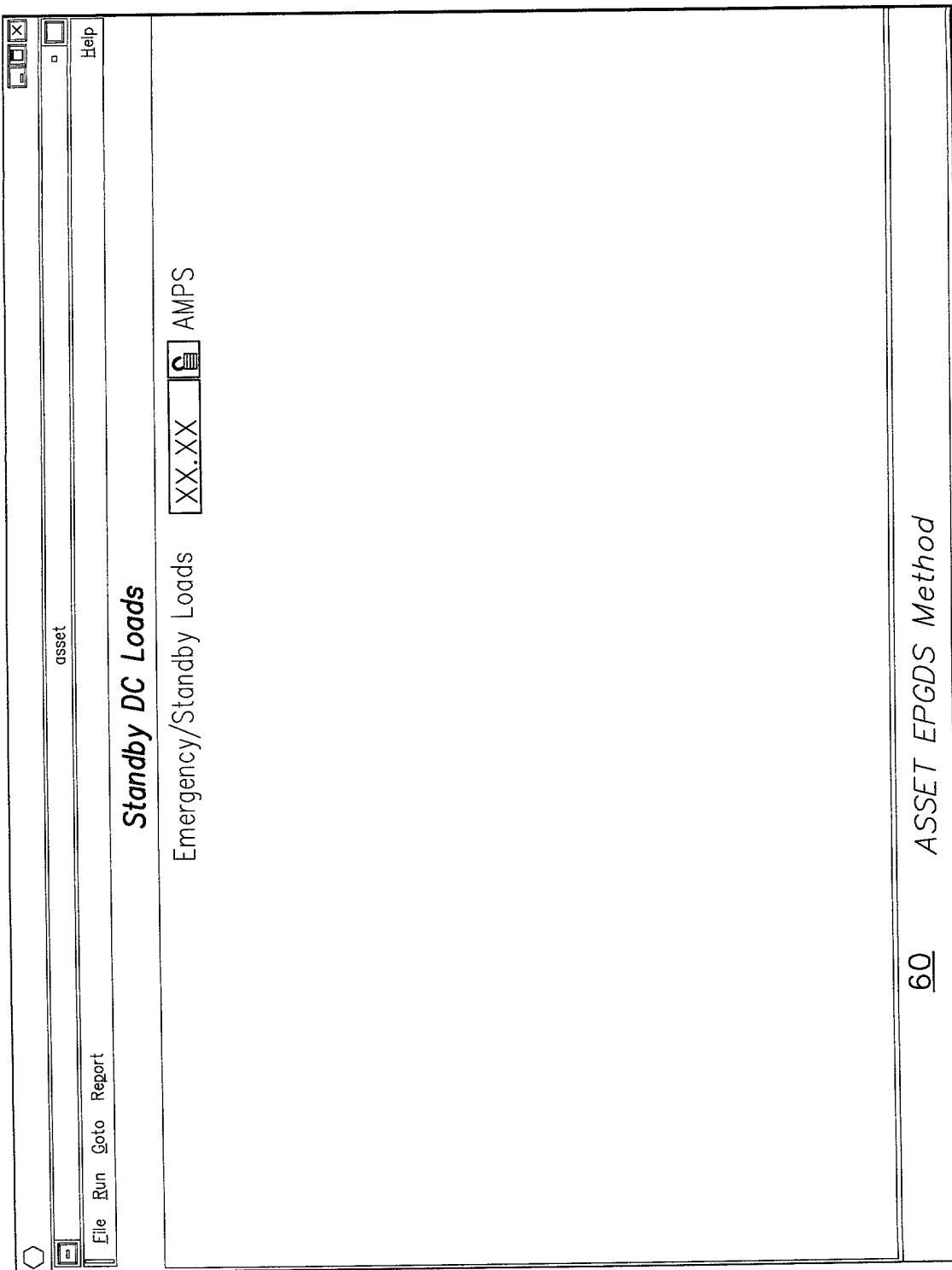


FIG. 12

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

19/87

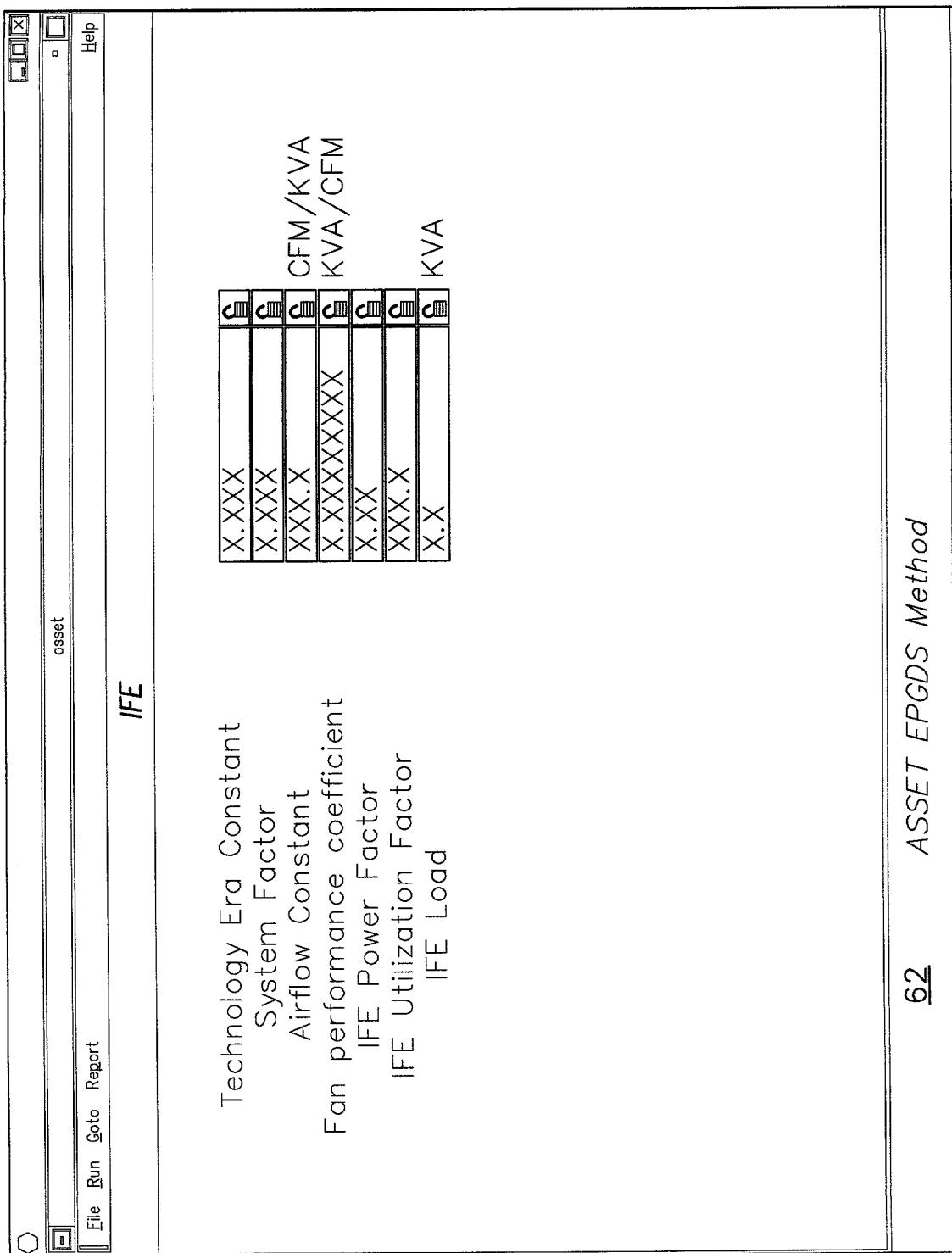


FIG. 13

62 ASSET EPGDS Method

20/87

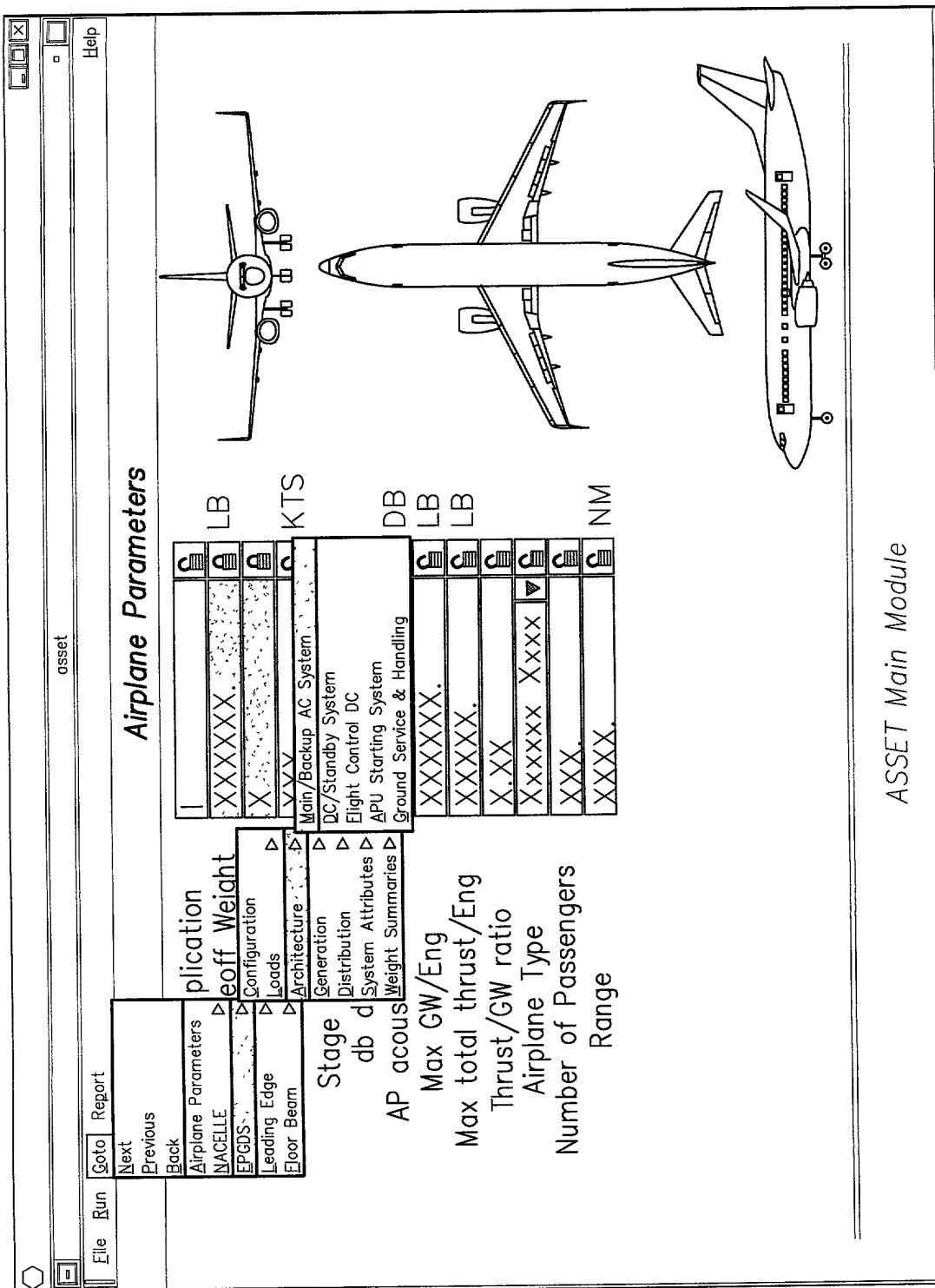


FIG. 14

21 / 87

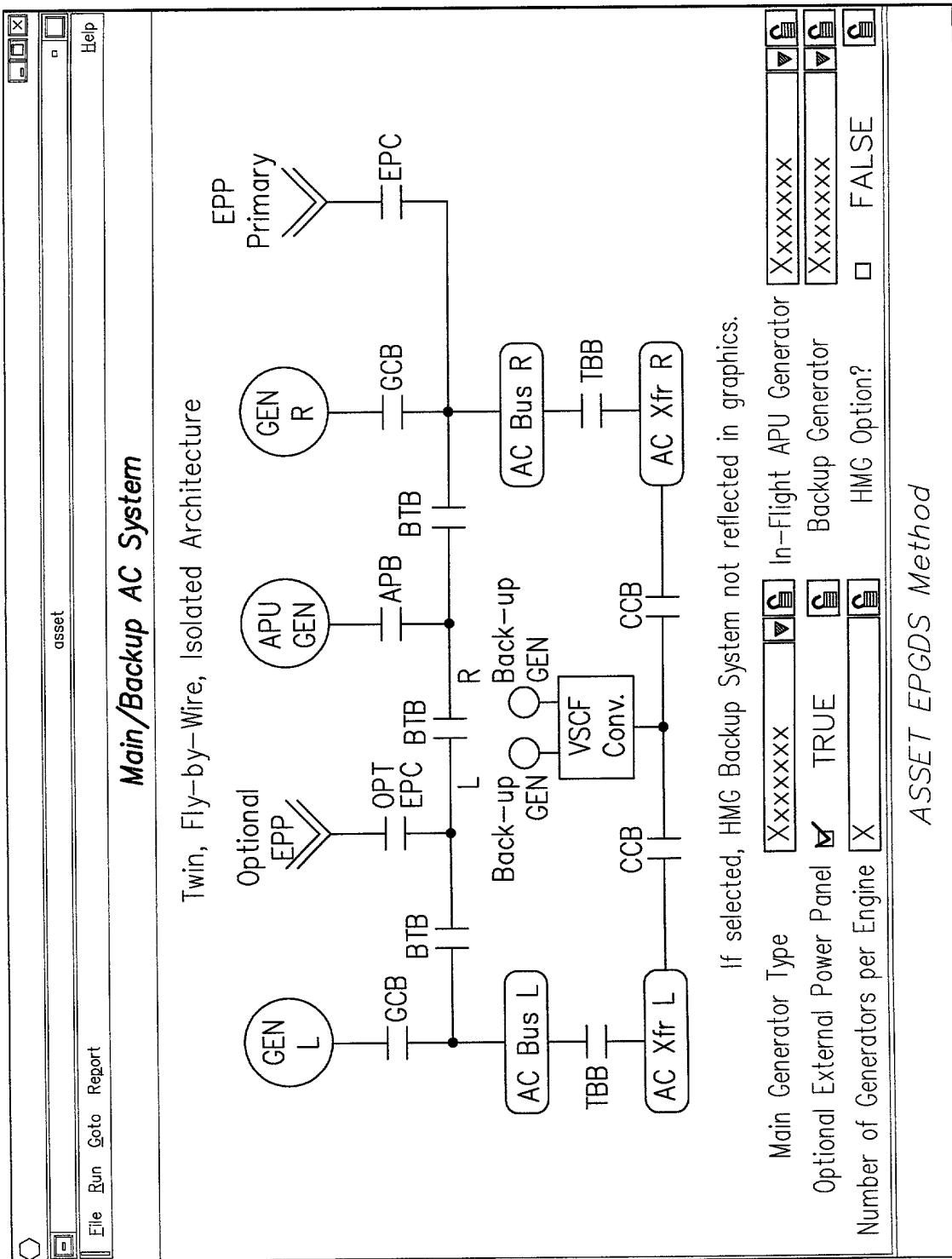
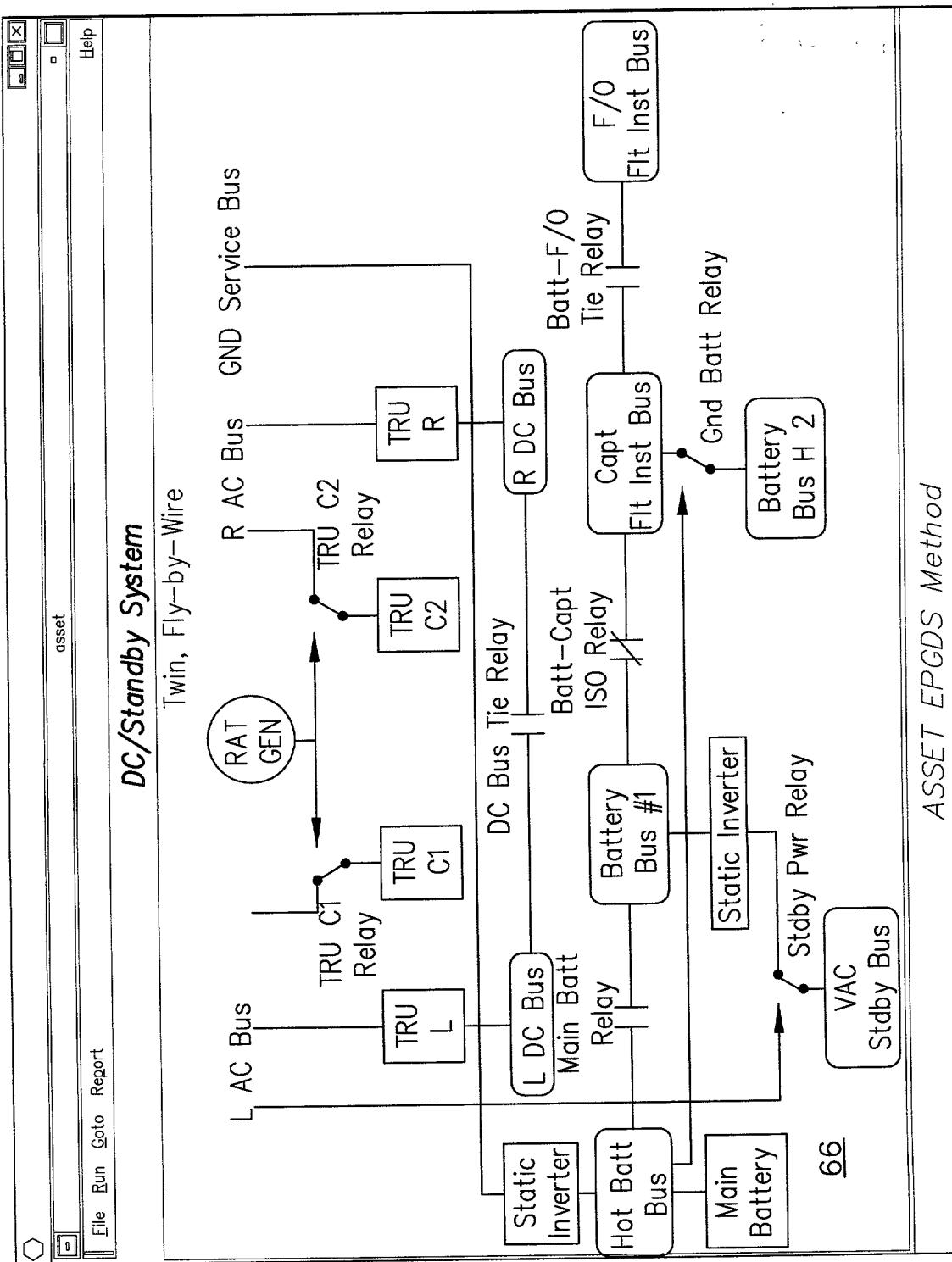


FIG. 15

22/87

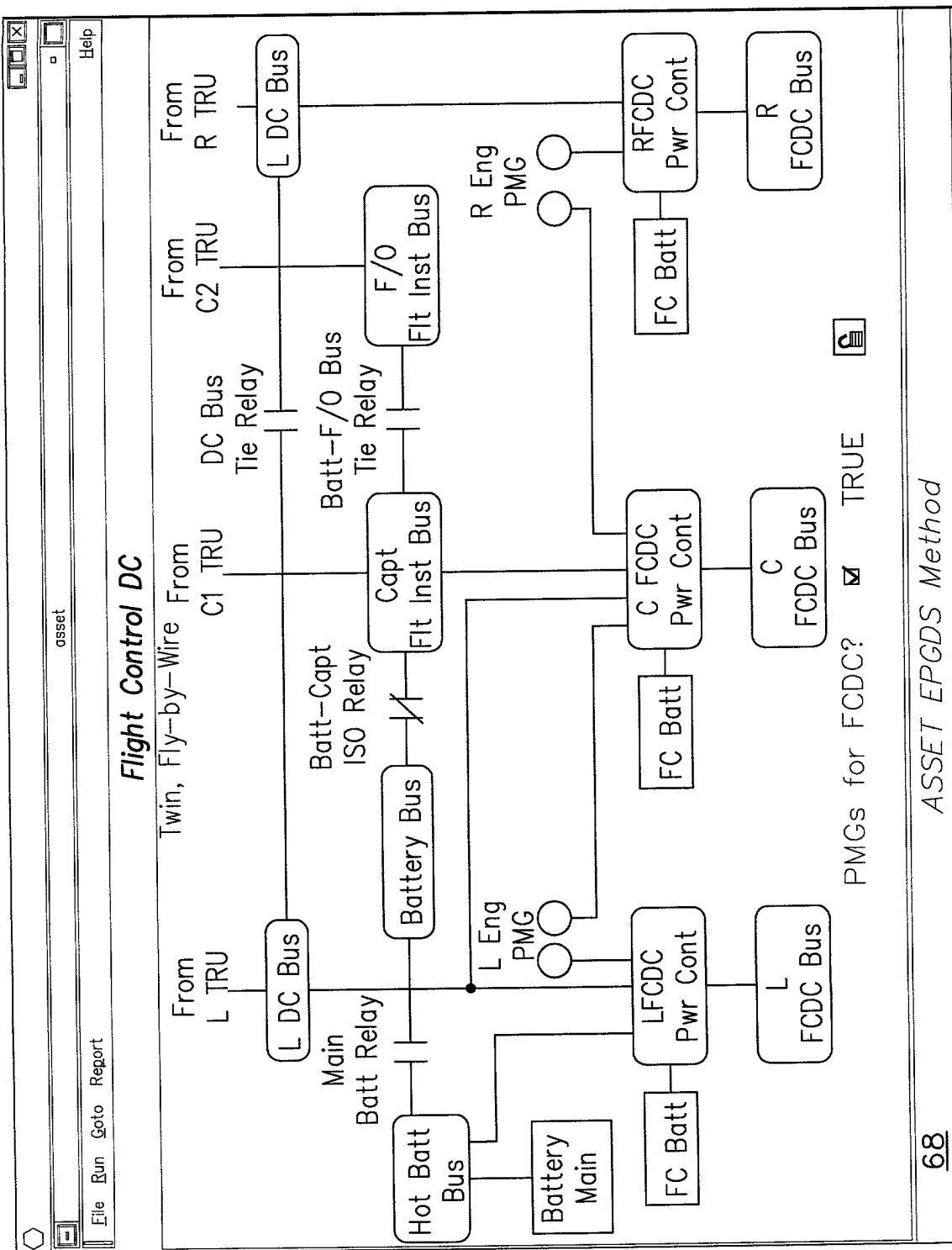


16

ASSET EPGDS Method

FIG.

23/87



G.
E.

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS
INVENTOR: BOND, et al.
SN: 09/900,522; FILED 7/6/01
ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

24/87

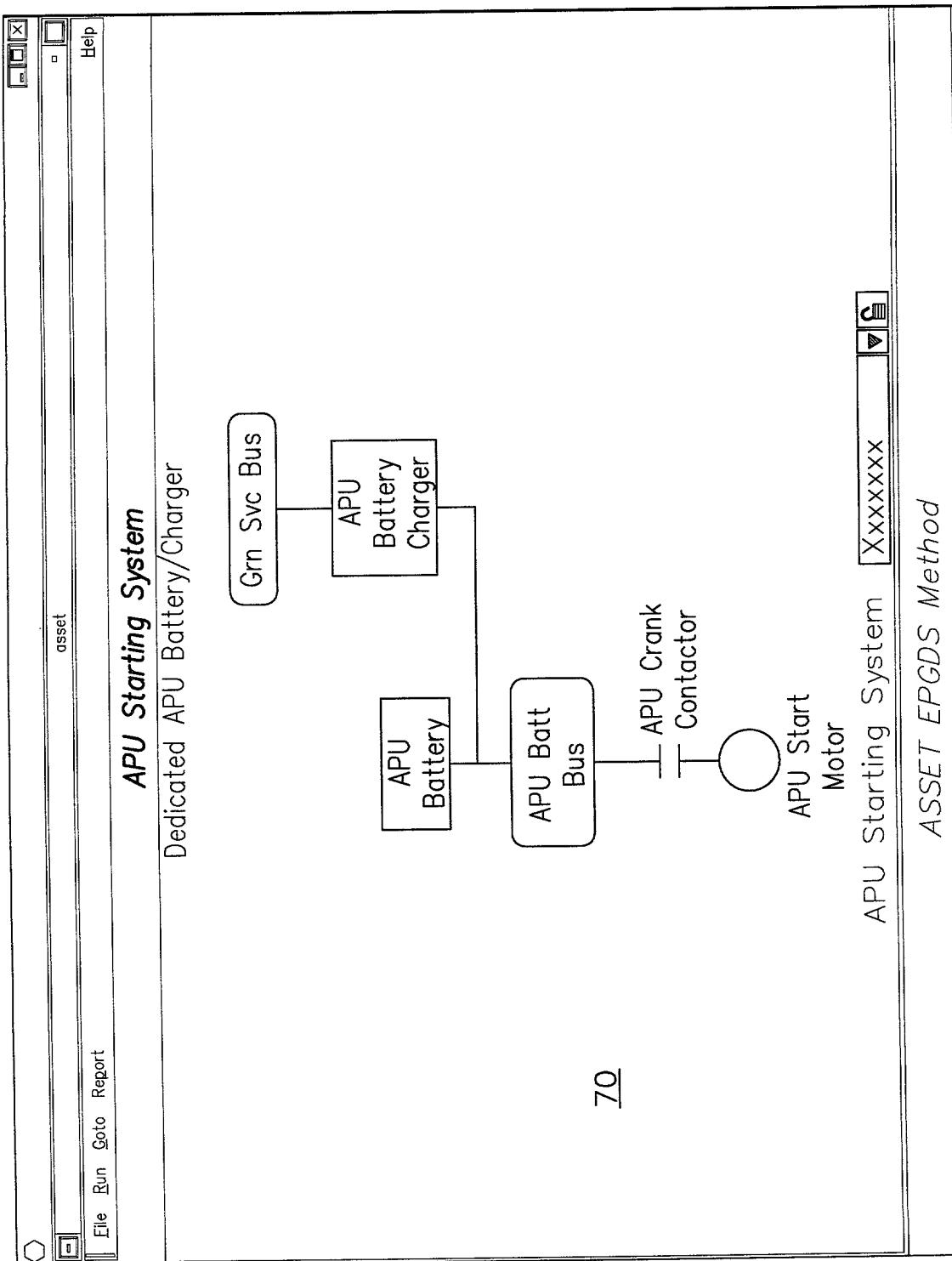


FIG. 18

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

25/87

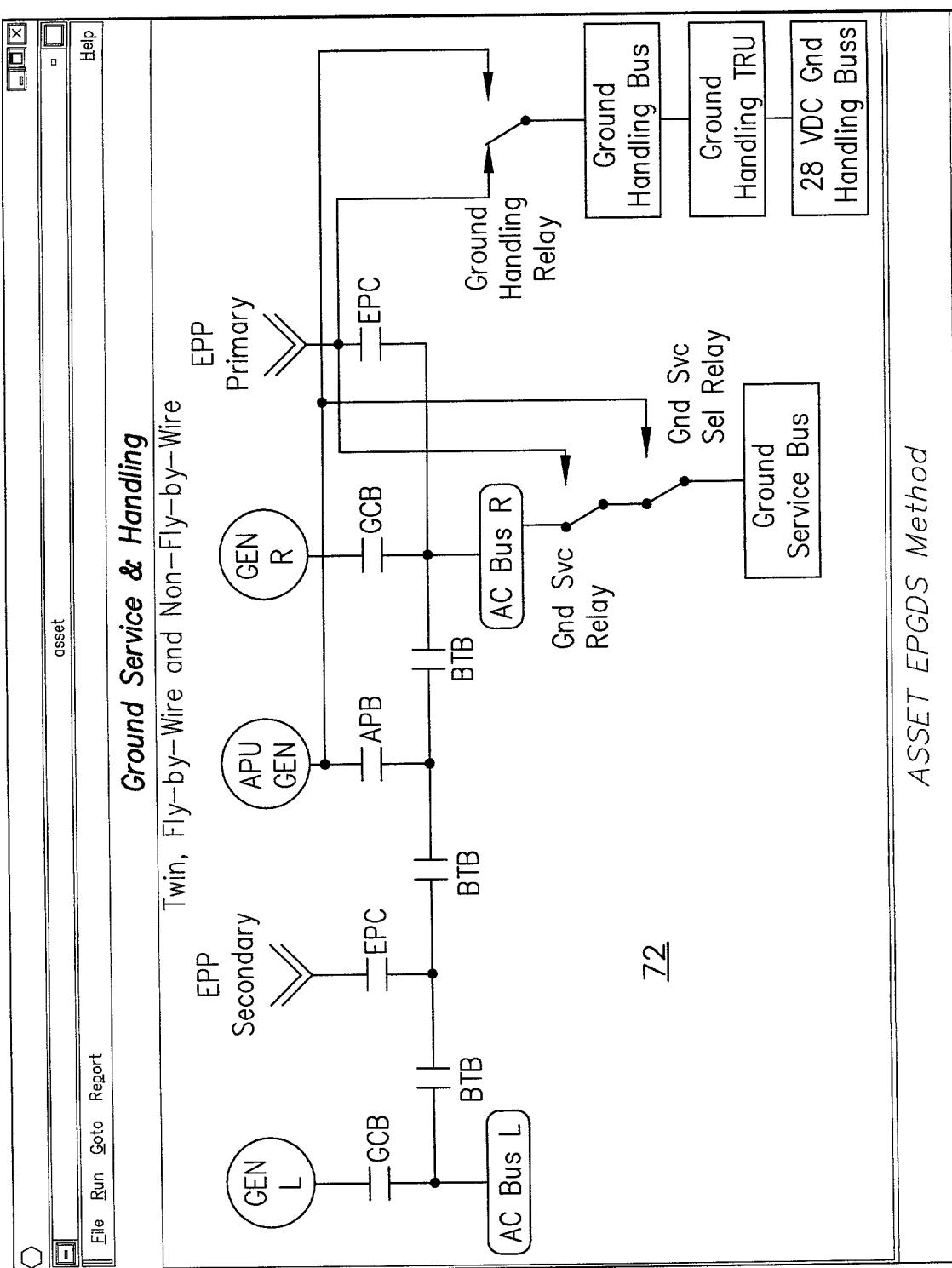


FIG. 19

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

26/87

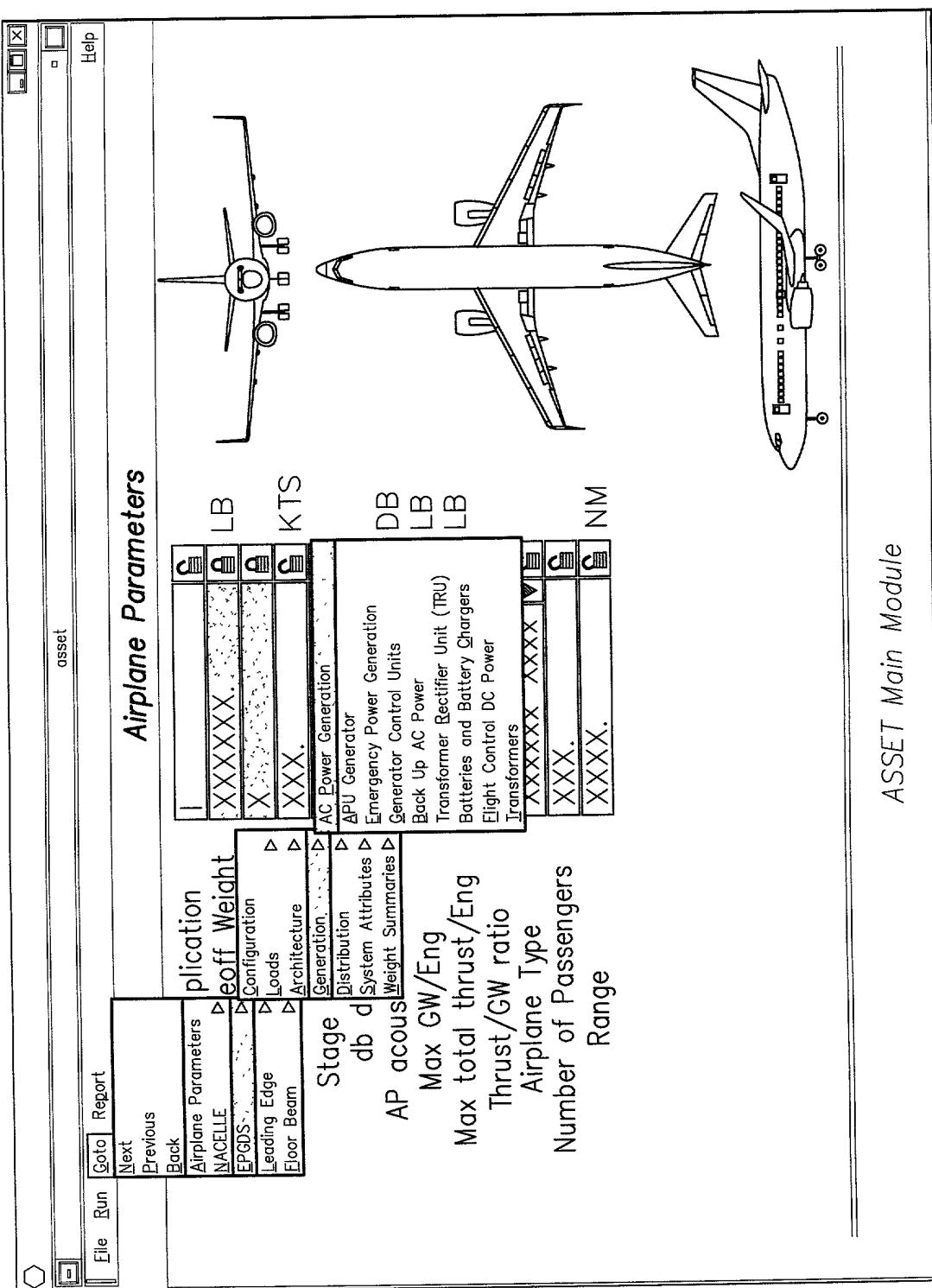


FIG. 20

27 / 87

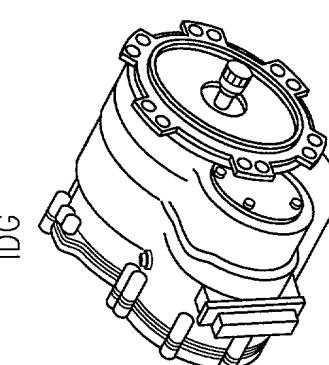
| AC Power Generation | | | | | | | |
|-----------------------------------------------------------------------------------|----------------------------------|-------------------------------------|----------------------------------|--------------------------------------|------------------------------------|-----------------------------------|--|
| Generator Input Speed | XXXXXX | <input type="button" value="RPM"/> | IDG | | | | |
| Method of Cooling | XXXXXX | <input type="button" value="▼"/> | | | | | |
| Generator Capacity | XX.X | <input type="button" value="KVA"/> | | | | | |
| Main AC Power Generator Weight | XXX.X | <input type="button" value="LB"/> | | | | | |
| VSCF Converter Config. | XXXXXX | <input type="button" value="▼"/> | | | | | |
| Maximum Converter Load | XX.X | <input type="button" value="KVA"/> | | | | | |
| Main Converter Unit Weight | XX.X | <input type="button" value="LB"/> | | | | | |
|  | | | | | | | |
| ATA | Chapter | Section | Title | Motor Controller Load KVA | Motor Controller Weight LB | | |
| < | <input type="button" value="C"/> | <input type="button" value=">"/> | <input type="button" value="C"/> | <input type="button" value="X.X"/> | <input type="button" value="X.X"/> | | |
| < | <input type="button" value="C"/> | <input type="button" value=">"/> | <input type="button" value="C"/> | <input type="button" value="X.X"/> | <input type="button" value="X.X"/> | | |
| < | <input type="button" value="C"/> | <input type="button" value=">"/> | <input type="button" value="C"/> | <input type="button" value="X.X"/> | <input type="button" value="X.X"/> | | |
| < | <input type="button" value="C"/> | <input type="button" value=">"/> | <input type="button" value="C"/> | <input type="button" value="X.X"/> | <input type="button" value="X.X"/> | | |
| < | <input type="button" value="C"/> | <input type="button" value=">"/> | <input type="button" value="C"/> | <input type="button" value="X.X"/> | <input type="button" value="X.X"/> | | |
| < | <input type="button" value="C"/> | <input type="button" value=">"/> | <input type="button" value="C"/> | <input type="button" value="X.X"/> | <input type="button" value="X.X"/> | | |
| < | <input type="button" value="C"/> | <input type="button" value=">"/> | <input type="button" value="C"/> | <input type="button" value="X.X"/> | <input type="button" value="X.X"/> | | |
| | | | | Total Motor Controller Weight | XX.X | <input type="button" value="LB"/> | |
| IDG Hydraulics | | | | <input type="button" value="X.XXX"/> | <input type="button" value="▼"/> | | |

FIG. 21

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

28/87

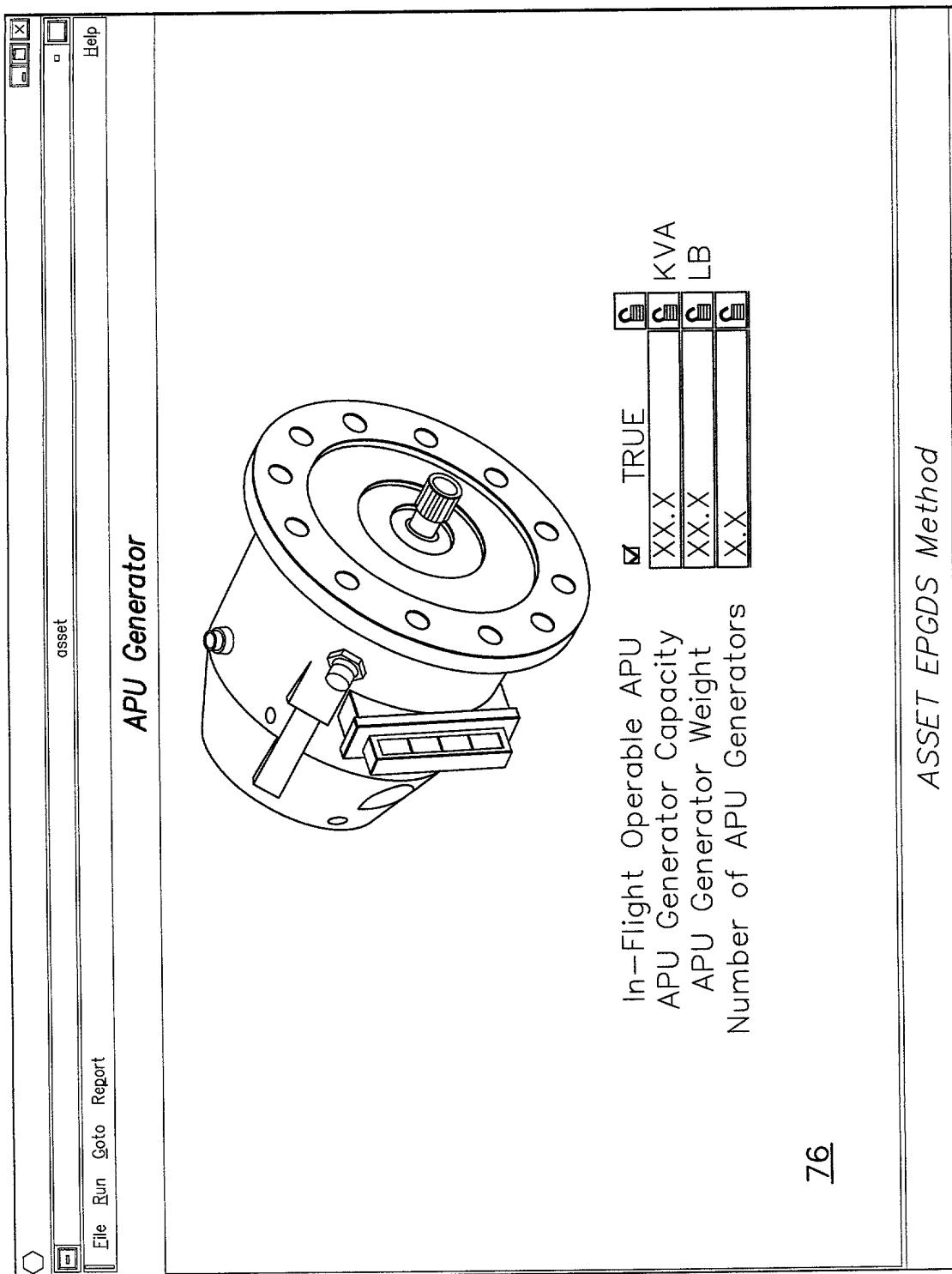


FIG. 22

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS
INVENTOR: BOND, et al.
SN: 09/900,522; FILED 7/6/01
ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

29 / 87

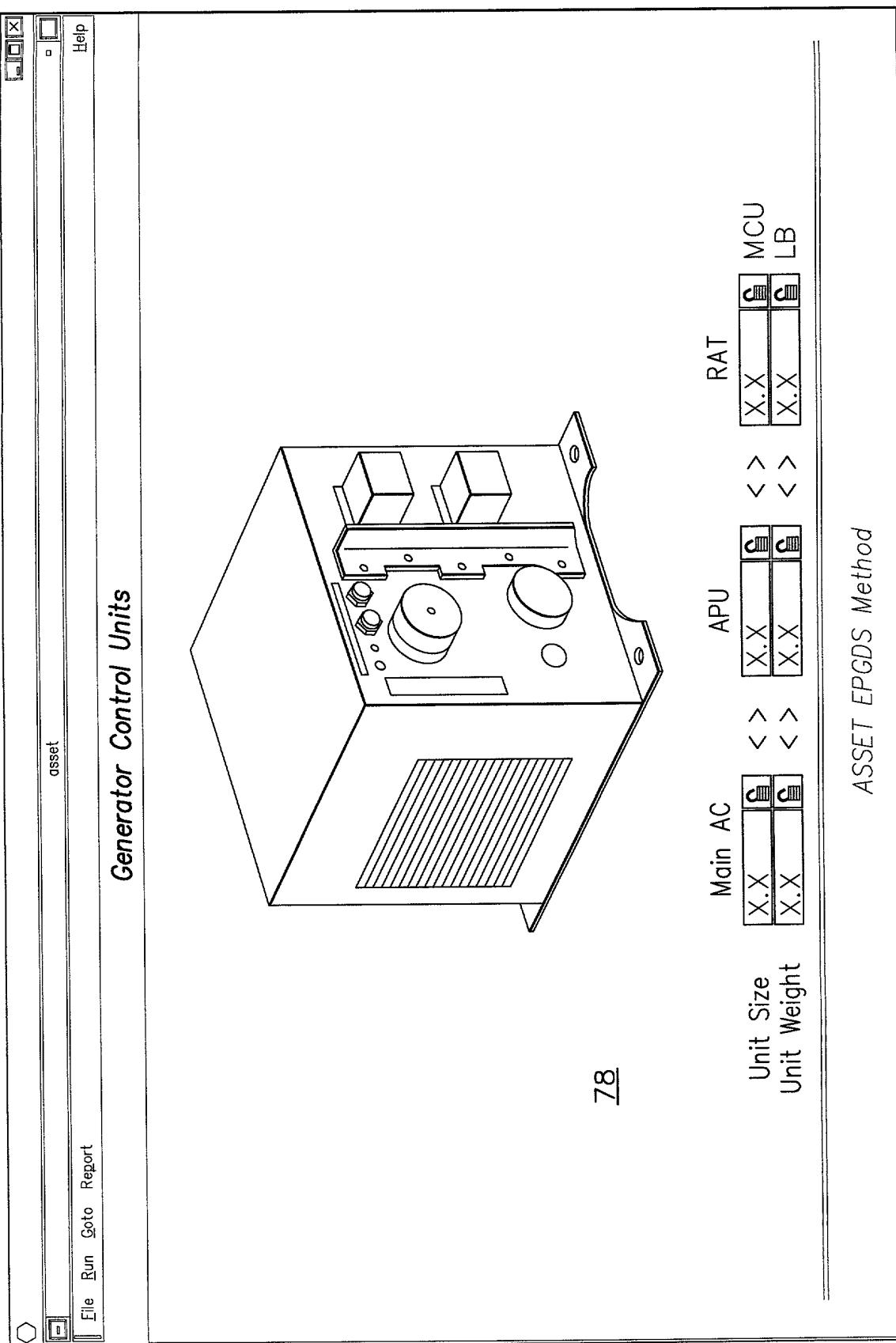


FIG. 23

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

30/87

asset

Help

File Run Goto Report

Back Up AC Power

PMGS

VSCF

Generator Type
Capacity
Cooling Method
Input speed
Generator Weight

| | | |
|----------|---|-----|
| Xxxxxxx | ▼ | KVA |
| XX.X | ▼ | |
| Xxxxxxx | ▼ | RPM |
| XXXXXX.X | ▼ | LB |
| XX.X | ▼ | |

Number/Engine
PMG Configuration
PMG Unit Weight

| | | |
|---------|---|----|
| X | ▼ | LB |
| Xxxxxxx | ▼ | |
| XX.X | ▼ | |

Converter Configuration
Converter Weight

| | | |
|---------|---|----|
| Xxxxxxx | ▼ | LB |
| XX.X | ▼ | |

ASSET EPGDS Method

80

FIG. 24

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

31 / 87

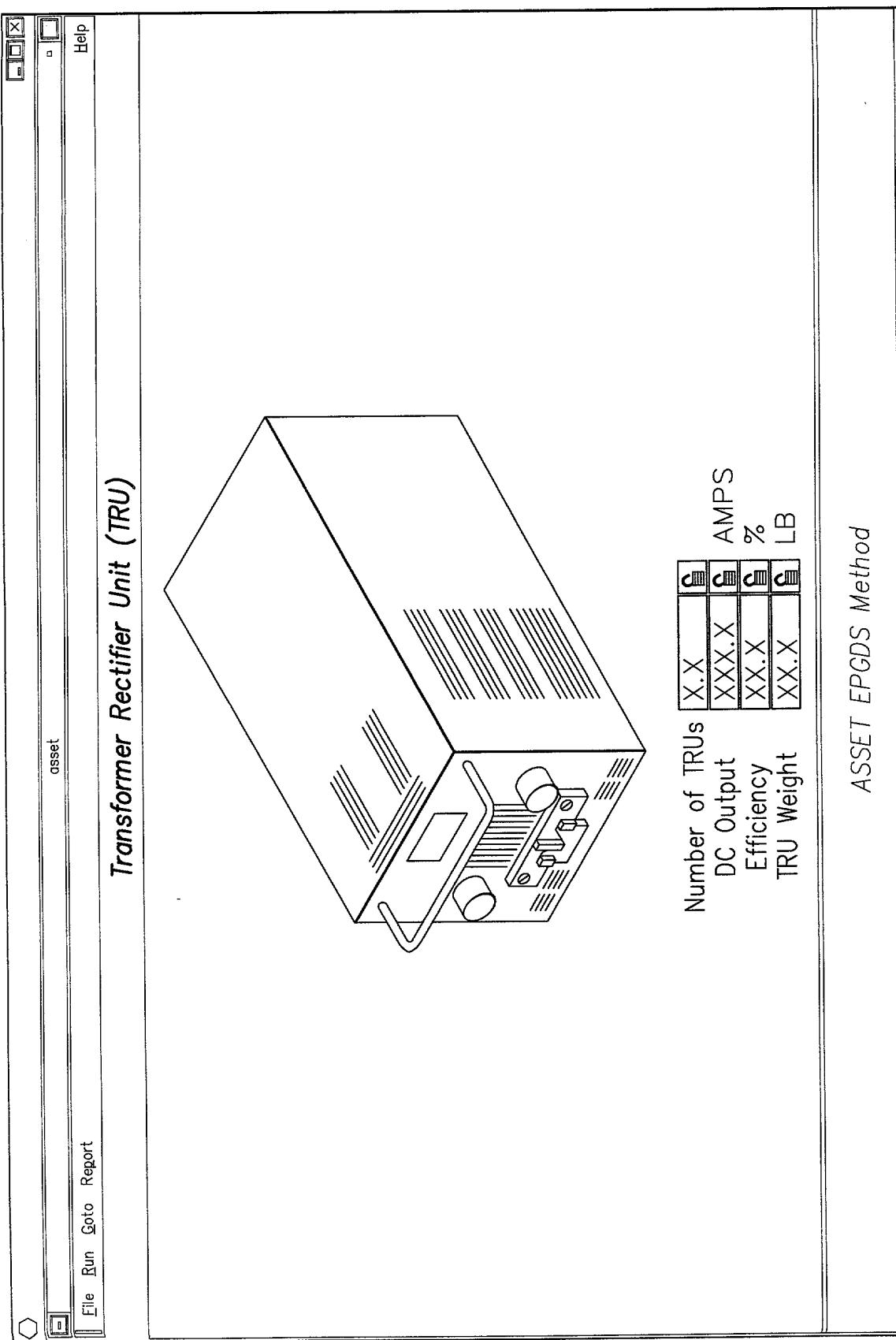


FIG. 25

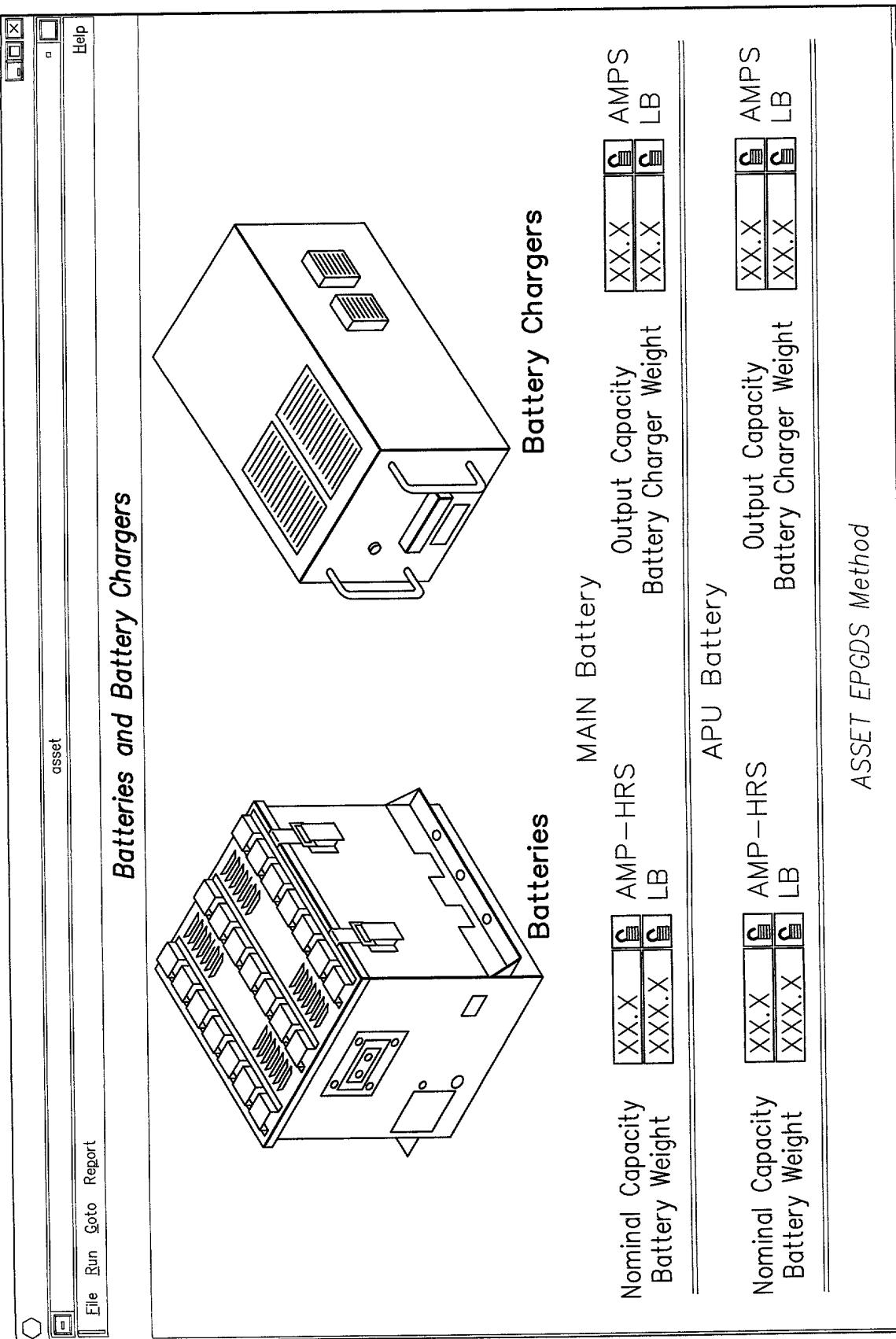


FIG. 26

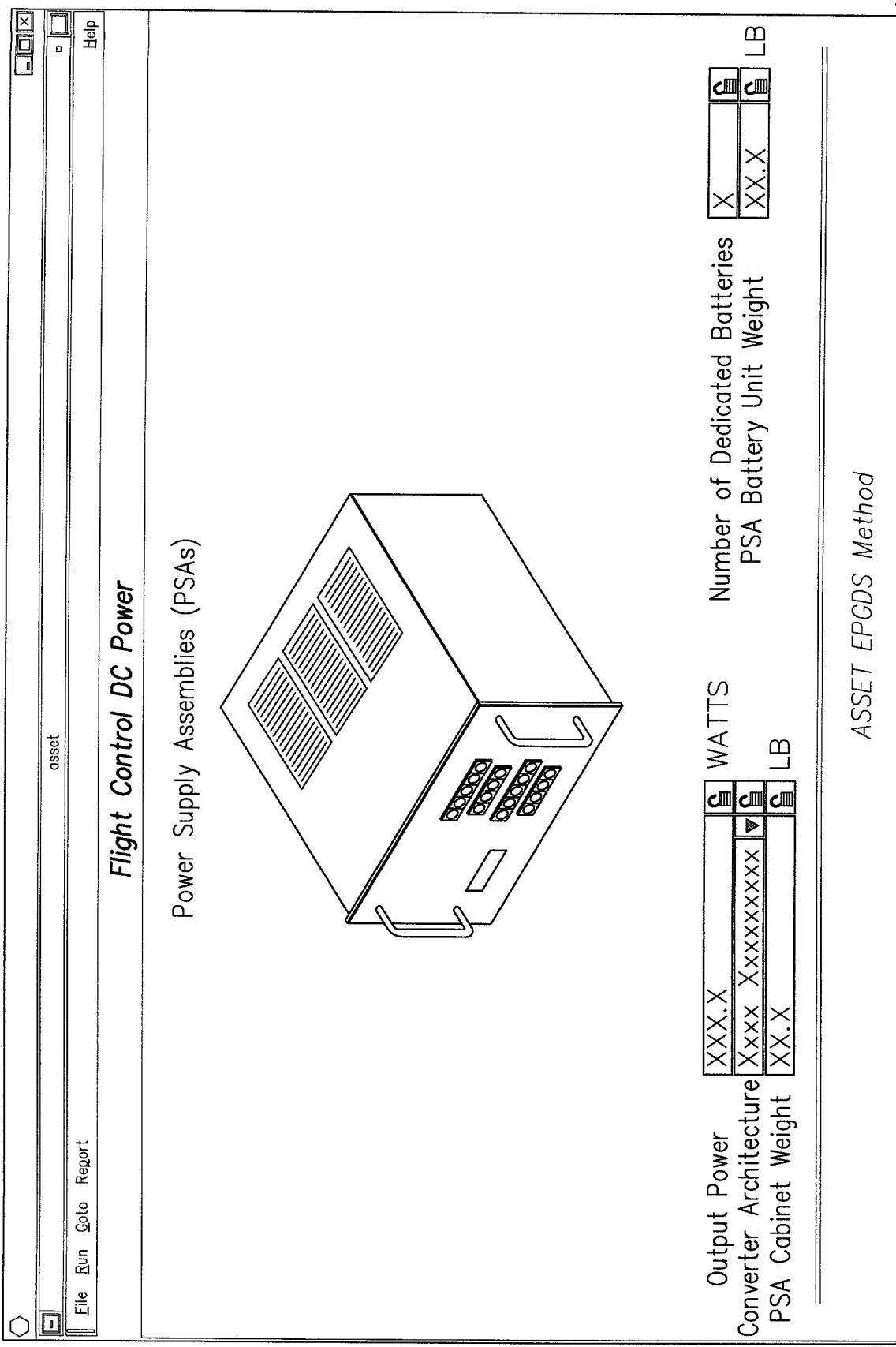
TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

33/87



TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

34/87

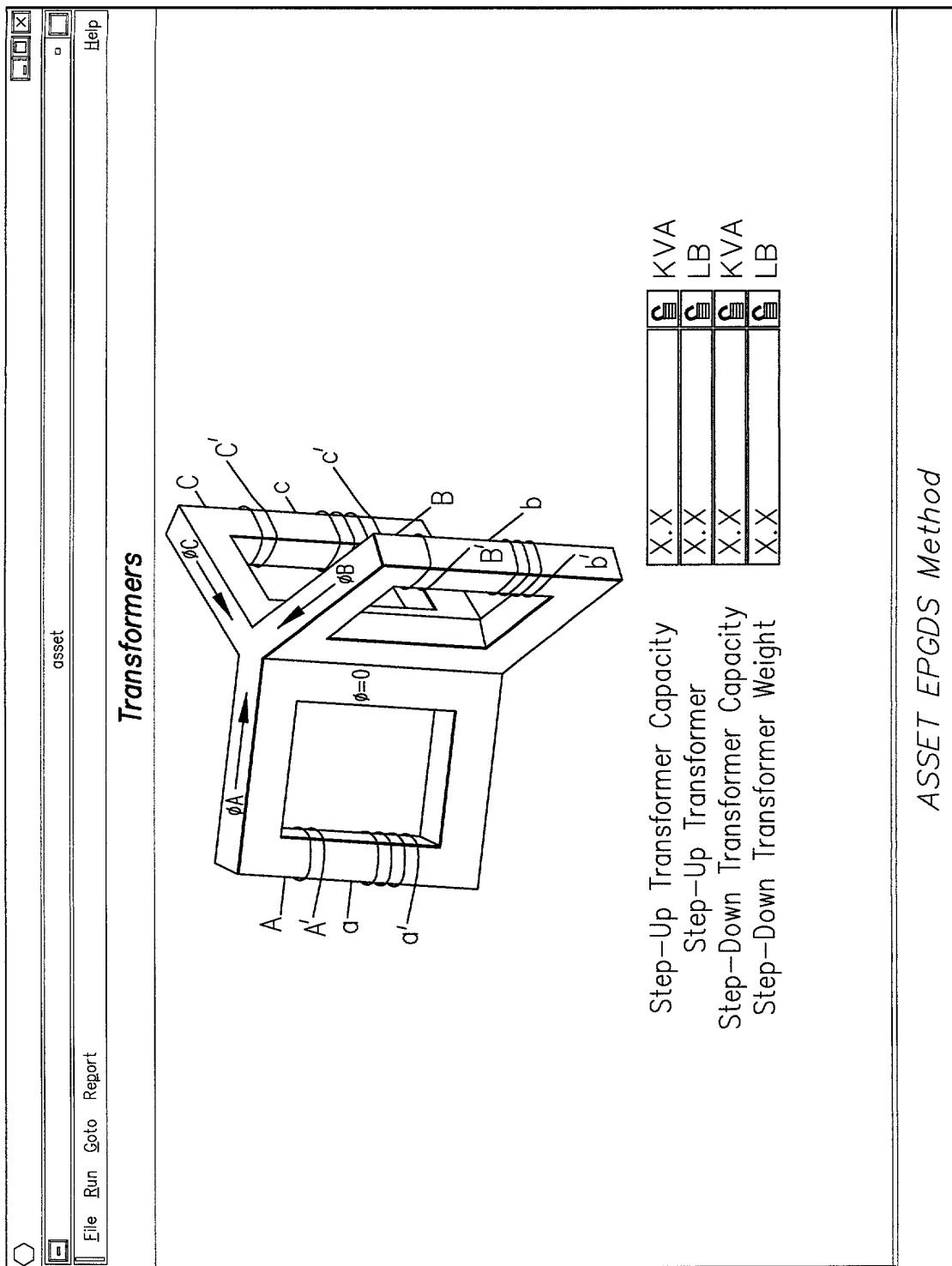


FIG. 28

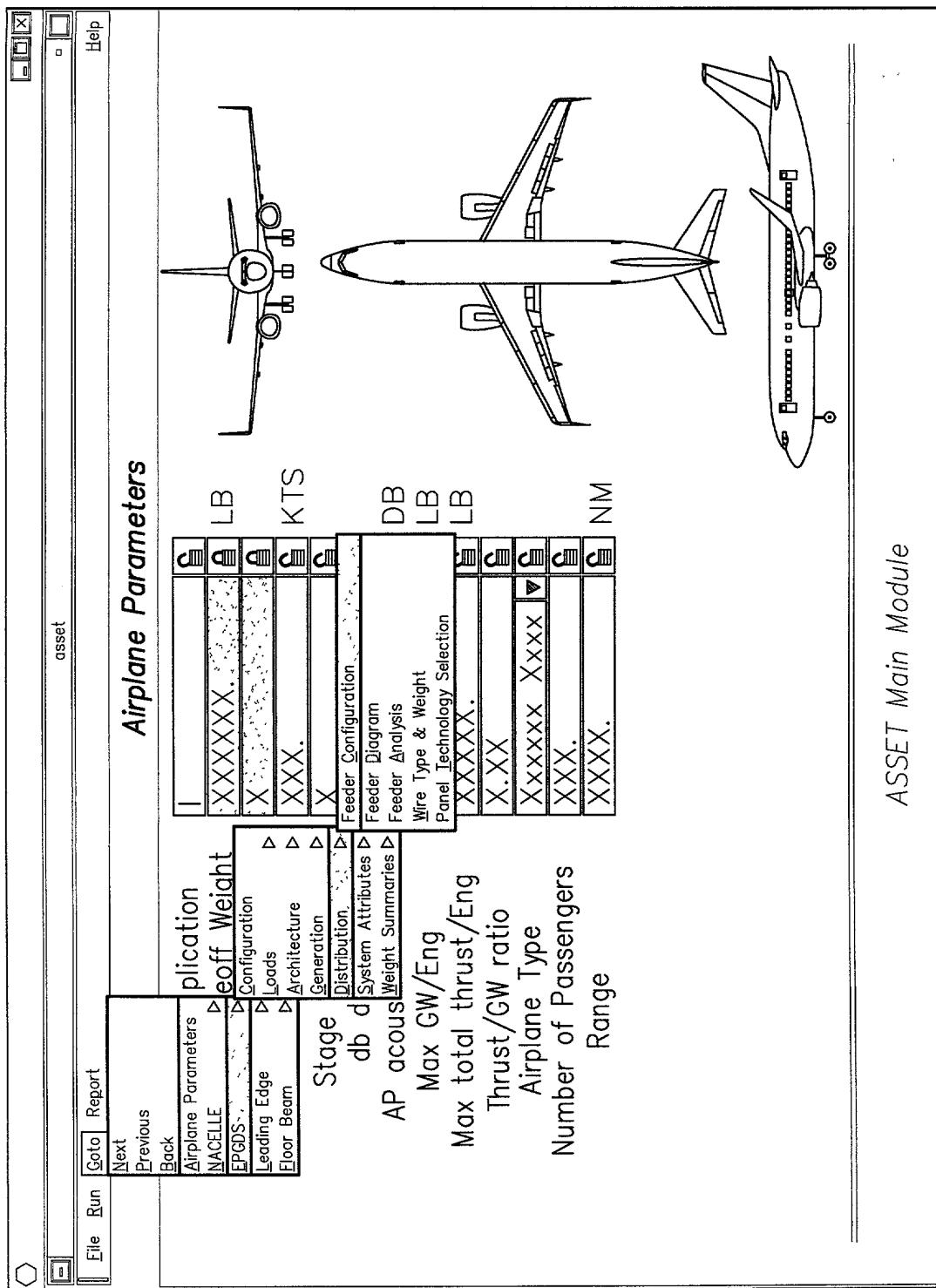


FIG. 29

File Run Goto Report asset Help

Show Data for: XXXX ▶

Feeder Configuration

| | | |
|-----------|-------------------|---|
| Feeder 1: | < > X-XXXX X/XXXX | ▼ |
| Feeder 2: | < > X-XXXX X/XXXX | ▼ |
| Feeder 3: | < > X-XXXX X/XXXX | ▼ |
| Feeder 4: | < > X-XXXX X/XXXX | ▼ |
| Feeder 5: | < > XXXX | ▼ |

Bundle Cross-Sections

| | | | | | |
|--------------|----------------|----------------|------------------|--------------|----------------|
| 3-Wire | 3-Wire w/Spctr | 2 3-Wire | 2 3-Wire w/Spctr | 6-Wire | 6-Wire w/Spctr |
| | | | | | |
| 3-Wire w/Ntr | w/Spctr | 2 3-Wire w/Mtr | 2 3-Wire w/Ntr | 6-Wire w/Ntr | Blank |
| | | | | | |

ASSET EPGDS Method

FIG. 30

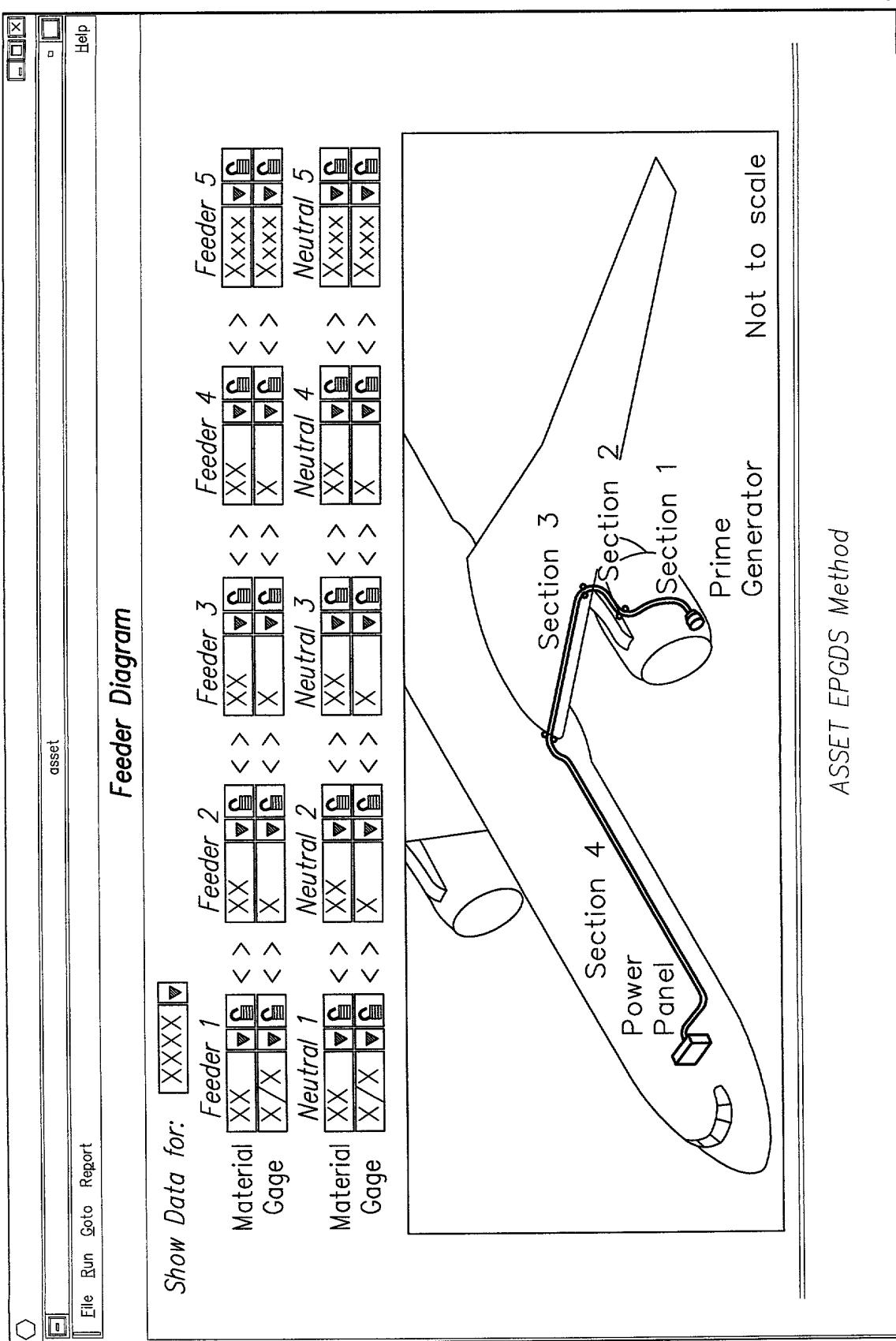


FIG. 31

Feeder Analysis

| | Feeder 1 | Feeder 2 | Feeder 3 | Feeder 4 | Feeder 5 |
|-------------------------|----------|----------|----------|----------|----------|
| Show Data for: XXXX▼ | XXXX.X | XXXX.X | XXXX.X | XXXX.X | XXXX.X |
| Phase Current | □ | □ | □ | □ | □ |
| Feeder Temperature Rise | □ | □ | □ | □ | □ |
| Bundle Derating | □ | □ | □ | □ | □ |
| Sizing Altitude | □ | □ | □ | □ | □ |
| Altitude Derating | □ | □ | □ | □ | □ |
| Ambient Temperature | □ | □ | □ | □ | □ |
| Feeder Temperature | □ | □ | □ | □ | □ |
| Max Wire Temperature | □ | □ | □ | □ | □ |
| Temperature Margin | □ | □ | □ | □ | □ |
| Feeder Length | □ | □ | □ | □ | □ |

| | | |
|----------------------|--------|-------|
| Maximum Voltage Drop | XX.XXX | VOLTS |
| Total Voltage Drop | XX.XXX | VOLTS |
| Voltage Drop Margin | XX.XXX | VOLTS |

FIG. 32

| Wire Type, Feeder 1: | Wire Type, Neutral 1: | Wire Type, Feeder 2: | Wire Type, Neutral 2: | Wire Type, Feeder 3: | Wire Type, Neutral 3: | Wire Type, Feeder 4: | Wire Type, Neutral 4: | Wire Type, Feeder 5: | Wire Type, Neutral 5: | Feeder 1: | Neutral 1: | Feeder 2: | Neutral 2: | Feeder 3: | Neutral 3: | Feeder 4: | Neutral 4: | Feeder 5: | Neutral 5: | TRU | Feeder | Weight | Total | Wire | Weight | ASSET | EPGDS | Method | | |
|----------------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|----------------------|-----------------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|------|--------|--------|-------|--------------------|--------|-------|-------|--------|--|--|
| <> XXX-XXX-Xxxx X | <> XXX-XXX-Xxxx X | <> XX.X | <> XX.X | <> XX.X | asset | File | Goto | Report | Help | Wire Type & Weight | | | | | | |
| Show Data for: XXXX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

FIG. 33

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS
INVENTOR: BOND, et al.
SN: 09/900,522; FILED 7/6/01
ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

40/87

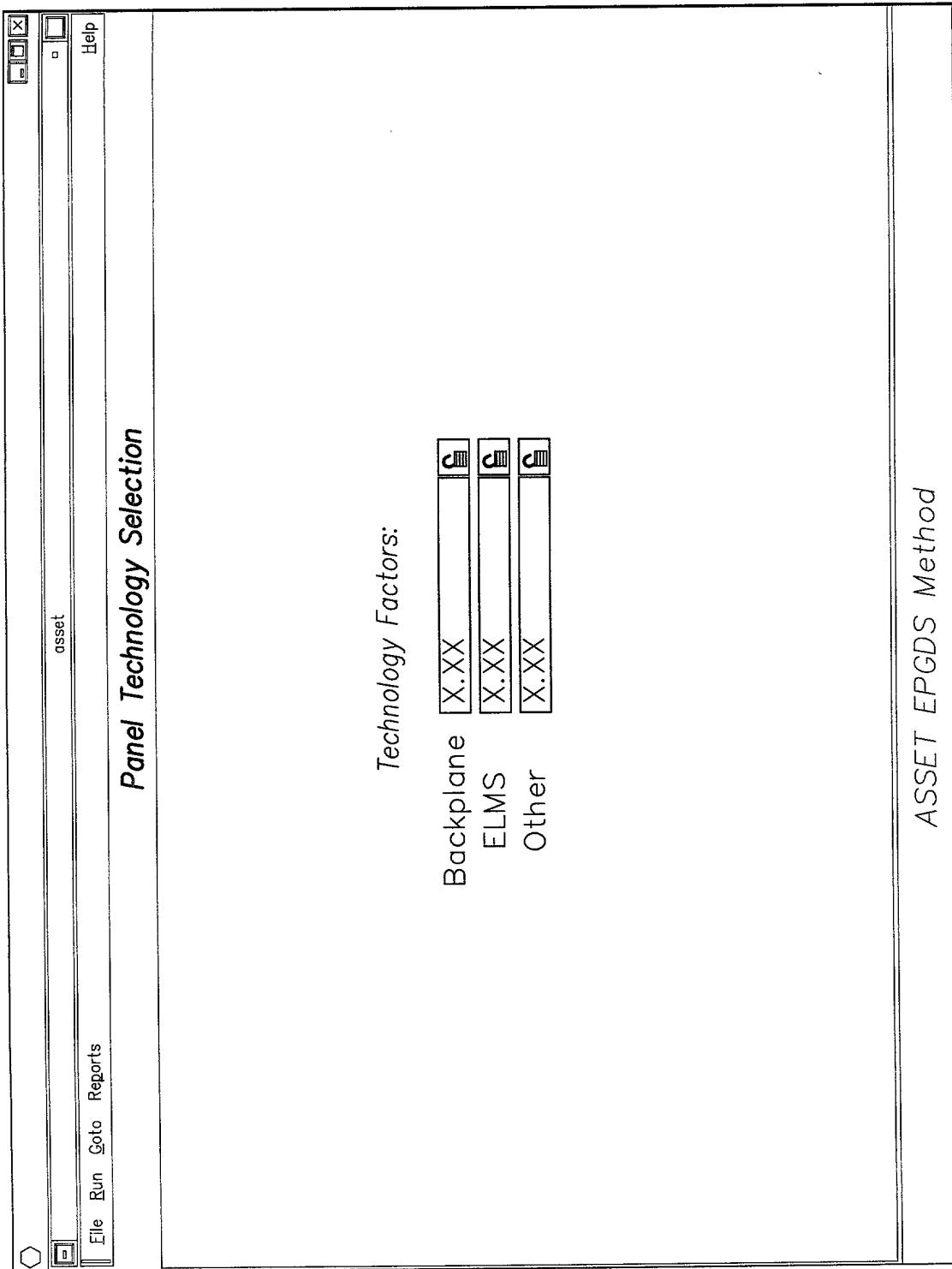


FIG. 34

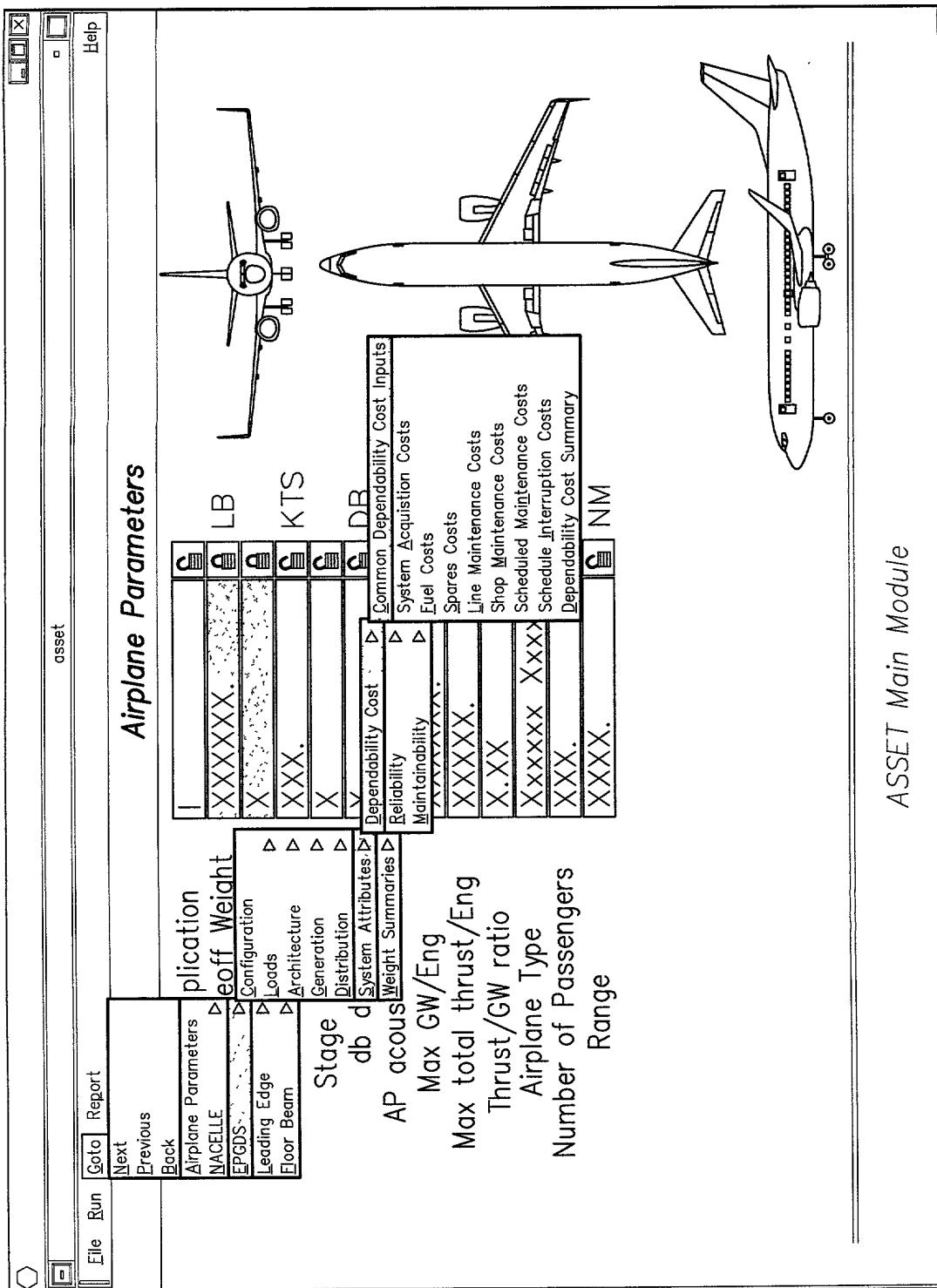


FIG. 35

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

42/87

ASSET EPGDS Method

Common Dependability Cost Inputs

| | |
|-----------------------------------------------------|--------|
| Number of Main Generators per Airplane | X |
| Average Number of Flights per Year per Airplane | XXXXX. |
| Average Flight Hours per Flight | XXX.XX |
| Airplane Feet Size | XX |
| Length of System Life in Years (1 – 30 Yrs.) | XX |
| Average Non-fuel Inflation Rate beyond Present Year | X.XXX |
| Minimum Attractive Rate of Return | X.XX |

ASSET

Run Report

File Goto Help

FIG. 36

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

43/87

The screenshot shows a software window titled "System Acquisition Costs". The menu bar includes "File", "Run", "Goto", "Report", and "Help". A toolbar on the left contains icons for "New", "Open", "Save", "Print", and "Exit". The main area displays three cost components:

| | |
|------------------------------------------------------|------------------------------|
| System Acquisition Cost, Base Year (per fleet) | <input type="text"/> DOLLARS |
| System Support Equipment Cost, Base Year (per fleet) | <input type="text"/> DOLLARS |
| System Initial Training Cost, Base Year (per fleet) | <input type="text"/> DOLLARS |

Below these is another row:

| | |
|-----------------------------------------------|----------------------------------------------------------|
| System Acquisition Cost per Airplane per Year | <input type="text"/> XXXXX. <input type="text"/> DOLLARS |
|-----------------------------------------------|----------------------------------------------------------|

On the right side of the window, the text "ASSET EPGDS Method" is visible.

FIG. 37

| Fuel Costs | |
|----------------------------------------------------|---------------------|
| Lbs Fuel Burned/Flight Hour | Base Year |
| System Weight (per airplane) | Lb |
| Direct Horsepower Requirement (per airplane) | HRS [^] -1 |
| System Drag Horsepower Requirement (per airplane) | HP |
| System Cooling Horsepower Requirement | HP |
| System Pound of Fuel per Block Trip (per airplane) | LB |
| Average Fuel Inflation Rate Beyond Present Year | % |
| Fuel Cost (NPV of Life Cycle Cost) | |
| Fuel Cost per Airplane per Year | DOLLARS |
| | DOLLARS |
| | DOLLARS |

ASSET EPGDS Method

FIG. 38

45/87

ASSET EPGDS Method

Spares Costs

| | | |
|----------------------------------------------|----------|---------|
| Cost/Spare Unit, Base Year | XXXXXX. | DOLLARS |
| Spares Holding Factor | XXX | % |
| Shop Turnaround Time in Days | XXX.X | DAY |
| Main Base Fill Rate (must be less than 1) | XX.XX | |
| Mean Time Between Unscheduled Removals | XXXXXX. | HRS |
| Mean Time Between Overhauls | X. | HRS |
| Number of Spares Required | XXXXXX. | |
| Initial Spares Cost | XXXXXXX. | DOLLARS |
| Spares Holding Cost (NPV of Life Cycle Cost) | XXXXXXX. | DOLLARS |
| Spares Cost (NPV of Life Cycle Cost) | XXXXXXX. | DOLLARS |
| Spares Cost per Airplane per Year | XXXXX. | DOLLARS |

FIG. 39

ASSET EPGDS Method

Line Maintenance Costs

| | | |
|---------------------------------------------------------|---------|-------------------|
| Direct Labor Rate per Hour | XXX.XXX | DOLLARS/HOUR |
| Maintenance Labor Burden Factor | X.X | |
| Mean Time Between Unscheduled Removals | XXXXXX. | HRS |
| Line Labor Hours Required per Removal | X.X | HRS |
| Line Labor Hours per Maintenance Action (Non-Removal) | X.X | HRS |
| Maintenance Actions per 1000 Flight Hours (Non-Removal) | X.XX | HRS ⁻¹ |

| | | |
|------------------------------------------------|---------|---------|
| Line Maintenance Cost (NPV of Life Cycle Cost) | XXXXXX. | DOLLARS |
| Line Maintenance Cost per Airplane per Year | XXX. | DOLLARS |

ASSET EPGDS Method

Shop Maintenance Costs

| | | |
|----------------------------------------------------------|---------|--------------|
| Direct Labor Rate per Hour | XX.XX | DOLLARS/HOUR |
| Maintenance Labor Burden Factor | X.X | |
| Mean Time Between Unscheduled Removals | XXXXXX. | HRS |
| Main Generator Mean Time Between Failures | XXXXXX. | HRS |
| Mean Time Between Overhauls | X. | HRS |
| Shop Labor Man-Hours per Unconfirmed Failure (Test Time) | X.X | HRS |
| Shop Labor Man-Hours per Failure (Repair and Test) | XXX.X | HRS |
| Shop Labor Hours per Overhaul | X.X | HRS |
| Average Shop Material Cost per Failure, base year | XXXXXX. | DOLLARS |
| Overhaul Materials Cost per Overhaul | X. | DOLLARS |

| | | |
|------------------------------------------------|-------------|---------|
| Shop Maintenance Cost (NPV of Life Cycle Cost) | XXXXXXXXXX. | DOLLARS |
| Shop Maintenance Cost per Airplane per Year | XXXXXX. | DOLLARS |

FIG. 41

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

48/87

ASSET EPGDS Method

Scheduled Maintenance Costs

| | | |
|-----------------------------------------------------|-------------|---------------------|
| Direct Labor Rate per Hour | XXX.XX | DOLLARS/HOUR |
| Maintenance Labor Burden Factor | X.X | |
| Mean Time Between Unscheduled Removals | XXXXXX. | HRS |
| Schedule Maintenance Inspection Man Hours per | | |
| 1000 Flight Hours | | |
| Rectification Man Hours per 1000 Flight Hours | X.X | |
| Scheduled Maintenance Material Dollars per | | |
| 1000 Flight Hours | X.XX | DOLLARS |
| | | HRS [^] -1 |
| Scheduled Maintenance Cost (NPV of Life Cycle Cost) | XXXXXXXXXX. | DOLLARS |
| Scheduled Maintenance Cost per Airplane per Year | XXXXX. | DOLLARS |

FIG. 42

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

49 / 87

ASSET EPGDS Method

Schedule Interruption Costs

| | | |
|--------------------------------------------|---------|--------------|
| Average Delay Cost per Delay Hour | XXXXXX. | DOLLARS/HOUR |
| Average Cancellation Cost per Cancellation | XXXXXX. | DOLLARS |
| Average Air Turnback Cost per Turnback | XXXXXX. | DOLLARS |
| Average Diversion Cost per Diversion | XXXXXX. | DOLLARS |

| | | |
|--------------------------------------------|--------|-----|
| Number of Delays per 100 Departures | X.XXXX | HRS |
| Average Delay Time (Hours) | X.XX | |
| Number of Cancellations per 100 Departures | XXXXXX | |
| Number of Air Turnbacks per 100 Departures | XXXXXX | |
| Number of Diversions per 100 Departures | X.XXXX | |

| | | |
|------------------------------------------------------|------------|---------|
| Schedule Interruptions Cost (NPV of Life Cycle Cost) | XXXXXXXXX. | DOLLARS |
| Schedule Interruptions Cost per Airplane per Year | XXXXXX. | DOLLARS |

FIG. 43

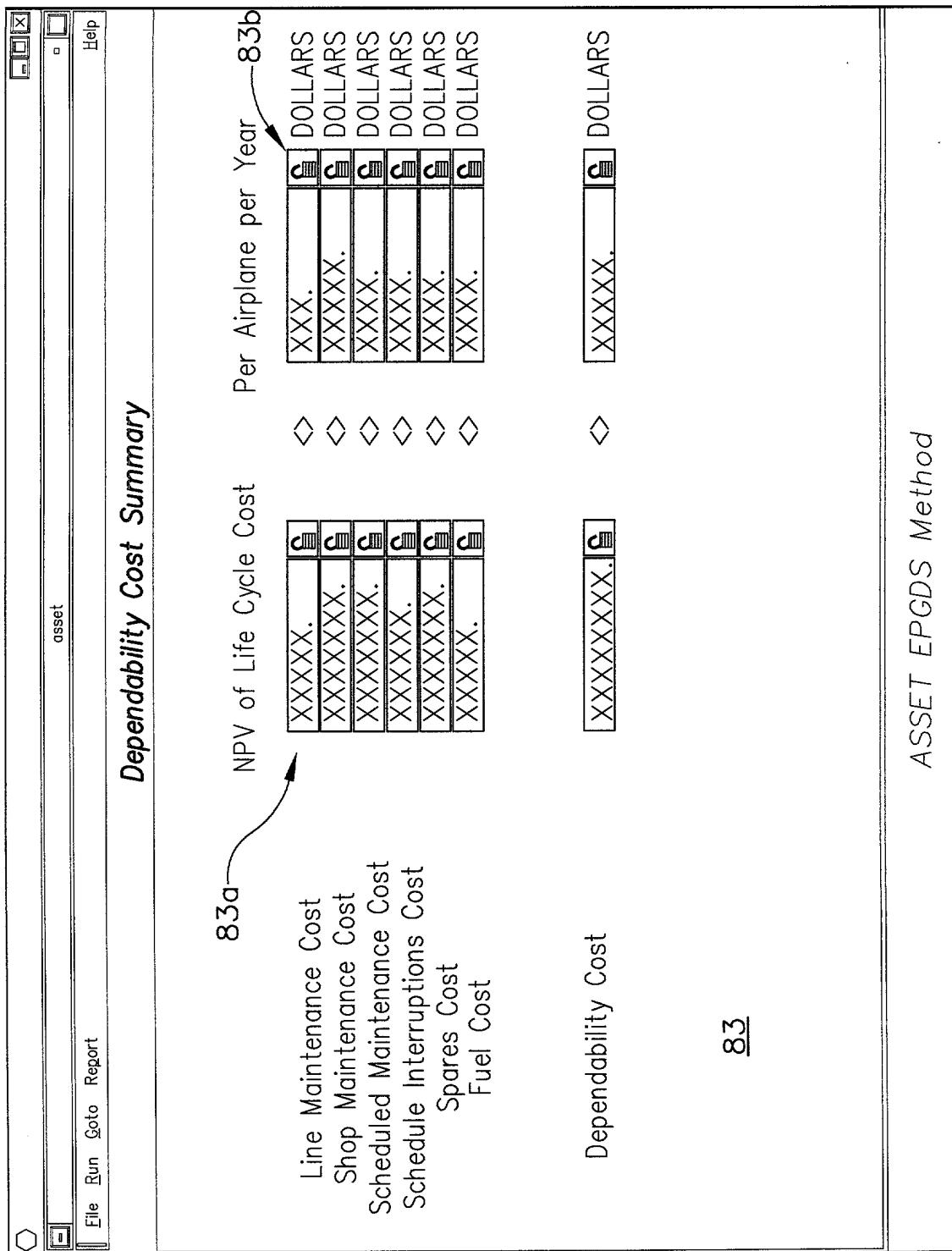


FIG. 44

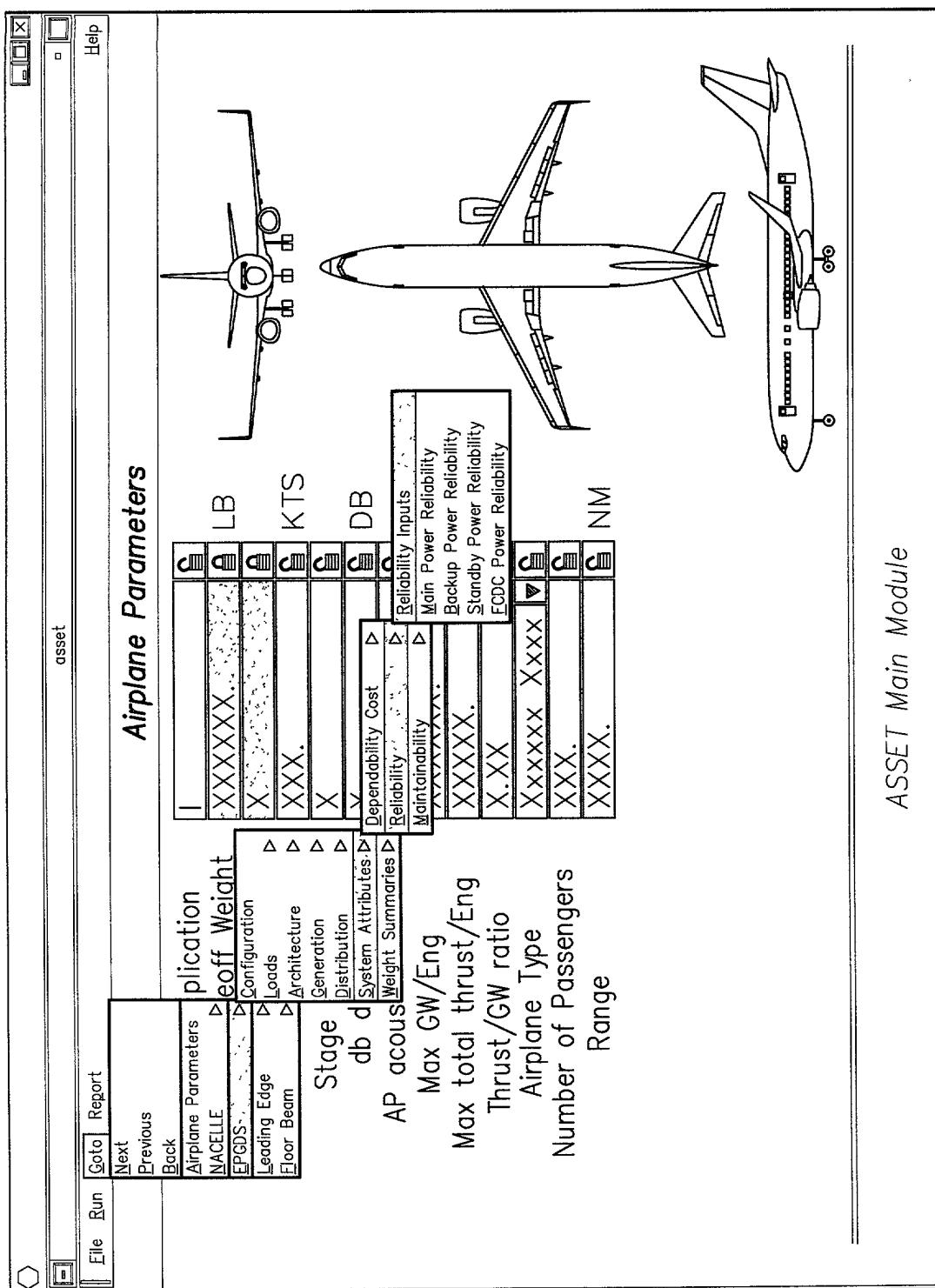
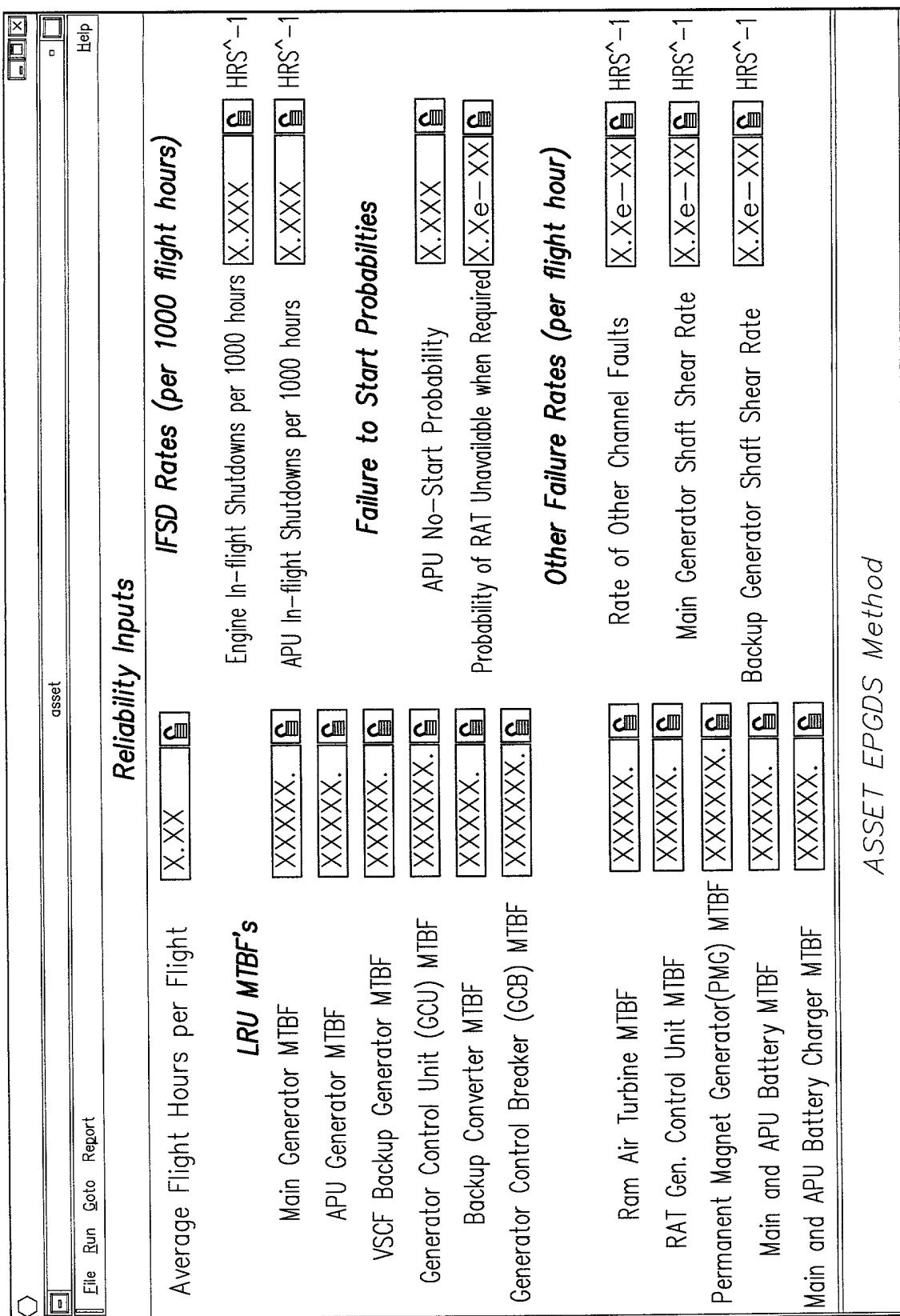


FIG. 45



The screenshot shows a software application window titled "ASSET EPGDS Method". The menu bar includes "File", "Run", "Goto", "Report", "asset", and "Help". The main area is a table titled "Reliability Inputs".

| Average Flight Hours per Flight | [X.XX] | IFSD Rates (per 1000 flight hours) |
|----------------------------------------------|----------|--------------------------------------------------------|
| LRU MTBF's | | |
| Main Generator MTBF | XXXXXX. | Engine In-flight Shutdowns per 1000 hours [X.XXXX] |
| APU Generator MTBF | XXXXXX. | APU In-flight Shutdowns per 1000 hours [X.XXXX] |
| VSCF Backup Generator MTBF | XXXXXX. | |
| Generator Control Unit (GCU) MTBF | XXXXXXX. | APU No-Start Probability [X.XXXX] |
| Backup Converter MTBF | XXXXXX. | Probability of RAT Unavailable when Required [X.Xe-XX] |
| Generator Control Breaker (GCB) MTBF | XXXXXXX. | |
| Failure to Start Probabilities | | |
| Ram Air Turbine MTBF | XXXXXX. | Rate of Other Channel Faults [X.Xe-XX] |
| RAT Gen. Control Unit MTBF | XXXXXX. | |
| Permanent Magnet Generator(PMG) MTBF | XXXXXXX. | Main Generator Shaft Shear Rate [X.Xe-XX] |
| Main and APU Battery MTBF | XXXXXX. | Backup Generator Shaft Shear Rate [X.Xe-XX] |
| Main and APU Battery Charger MTBF | XXXXXX. | |
| Other Failure Rates (per flight hour) | | |
| ASSET EPGDS Method | | |

FIG. 46

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

53/87

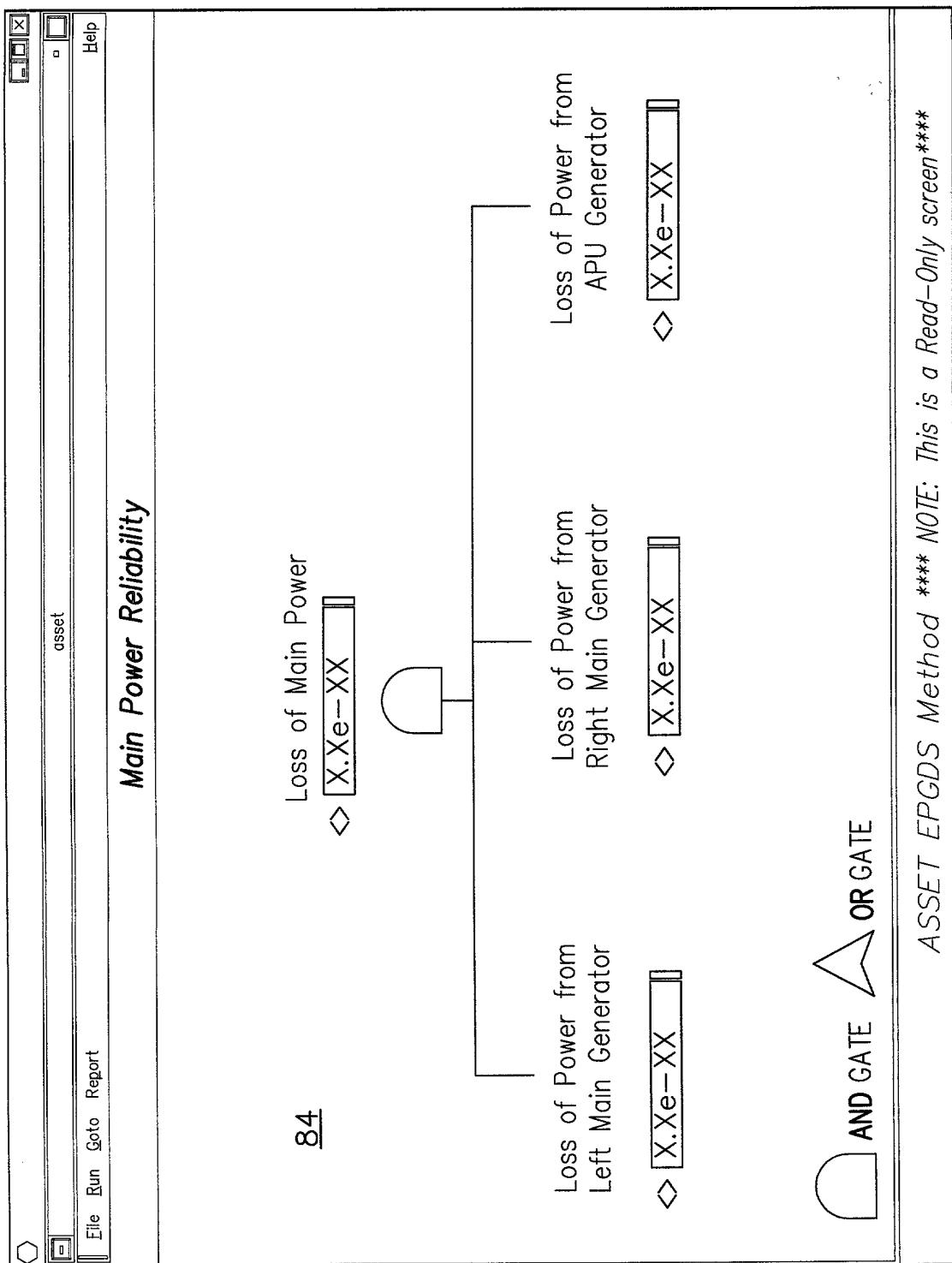


FIG. 47

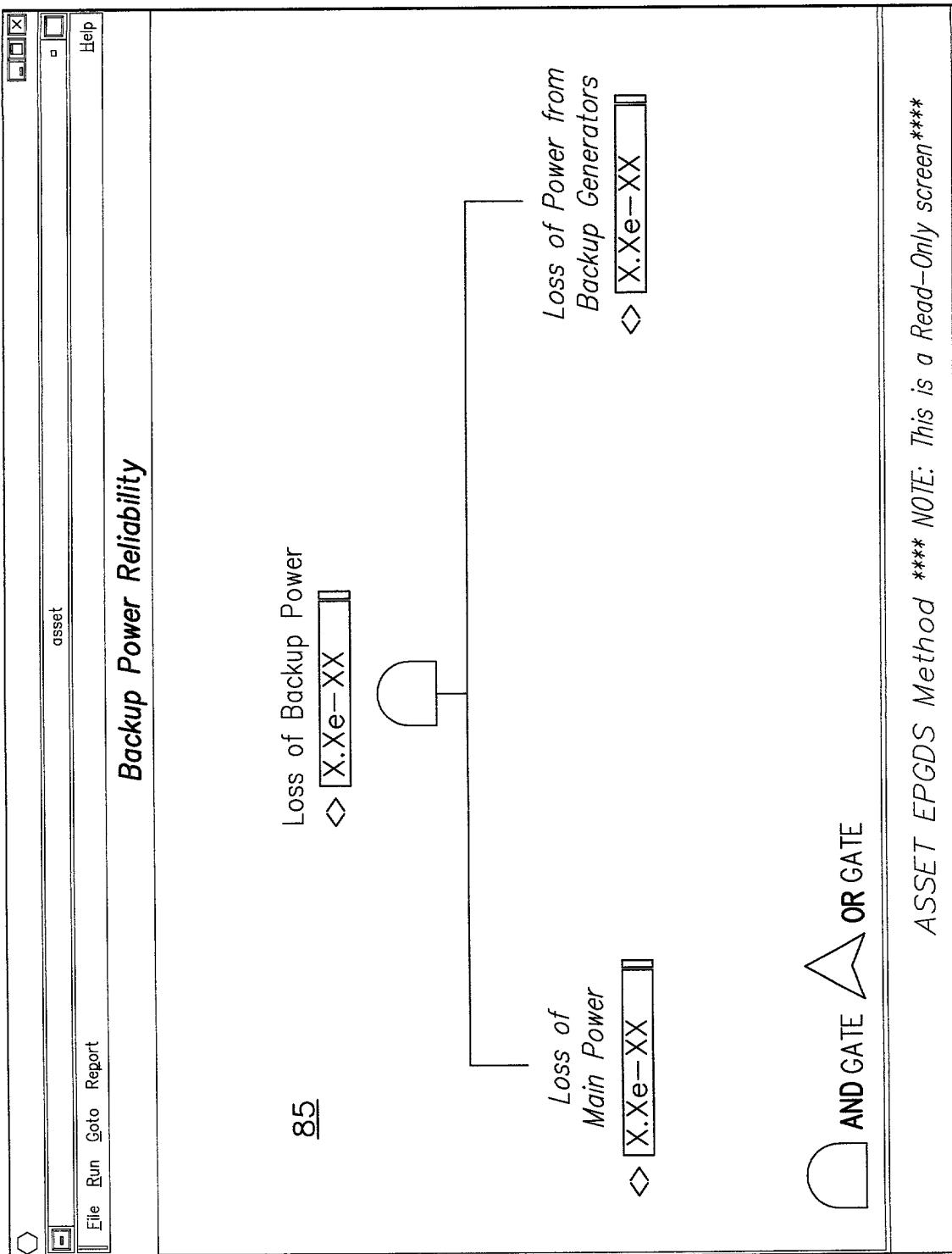
TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

54/87



48

FIG.

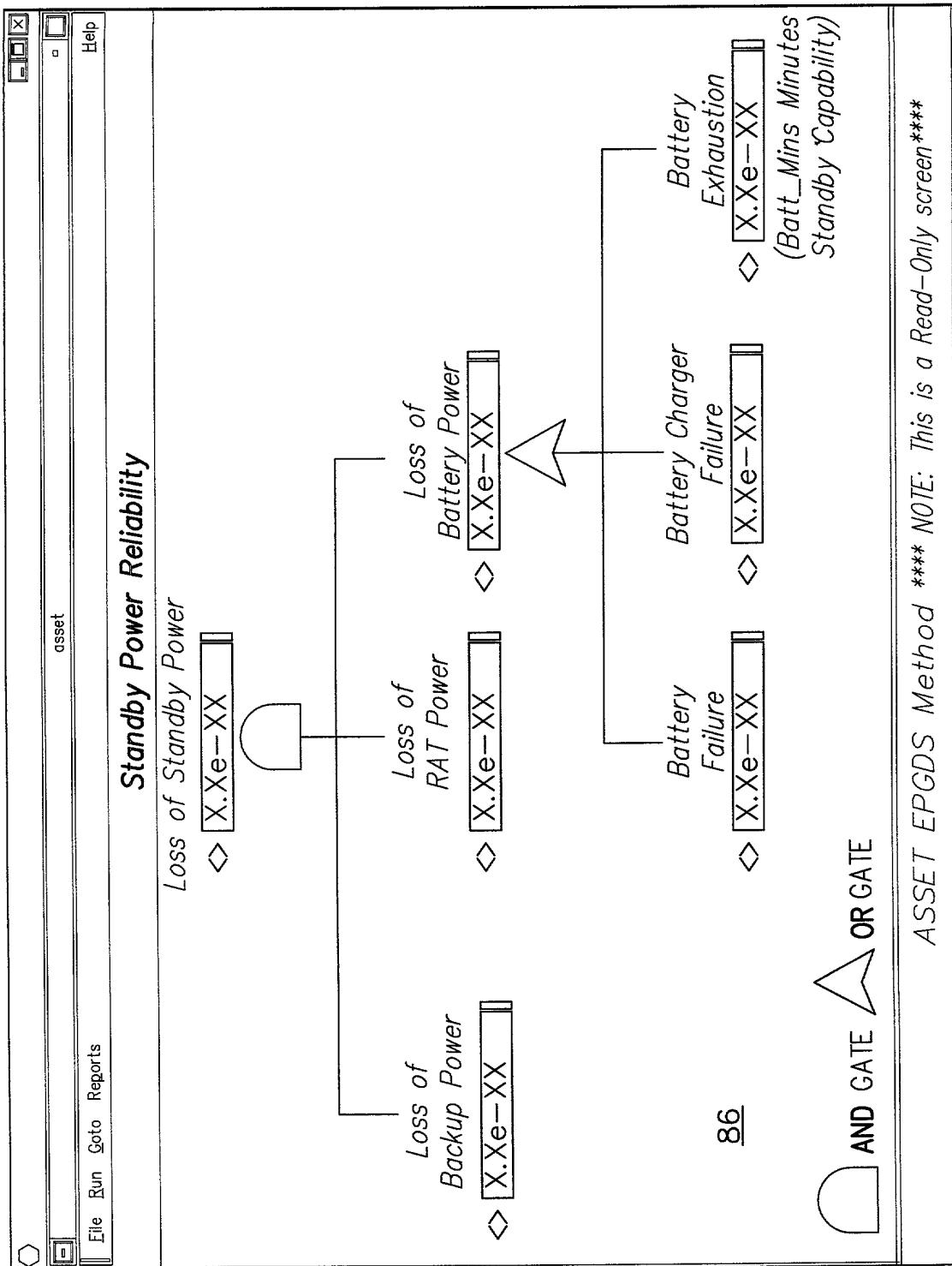


FIG. 49

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

56/87

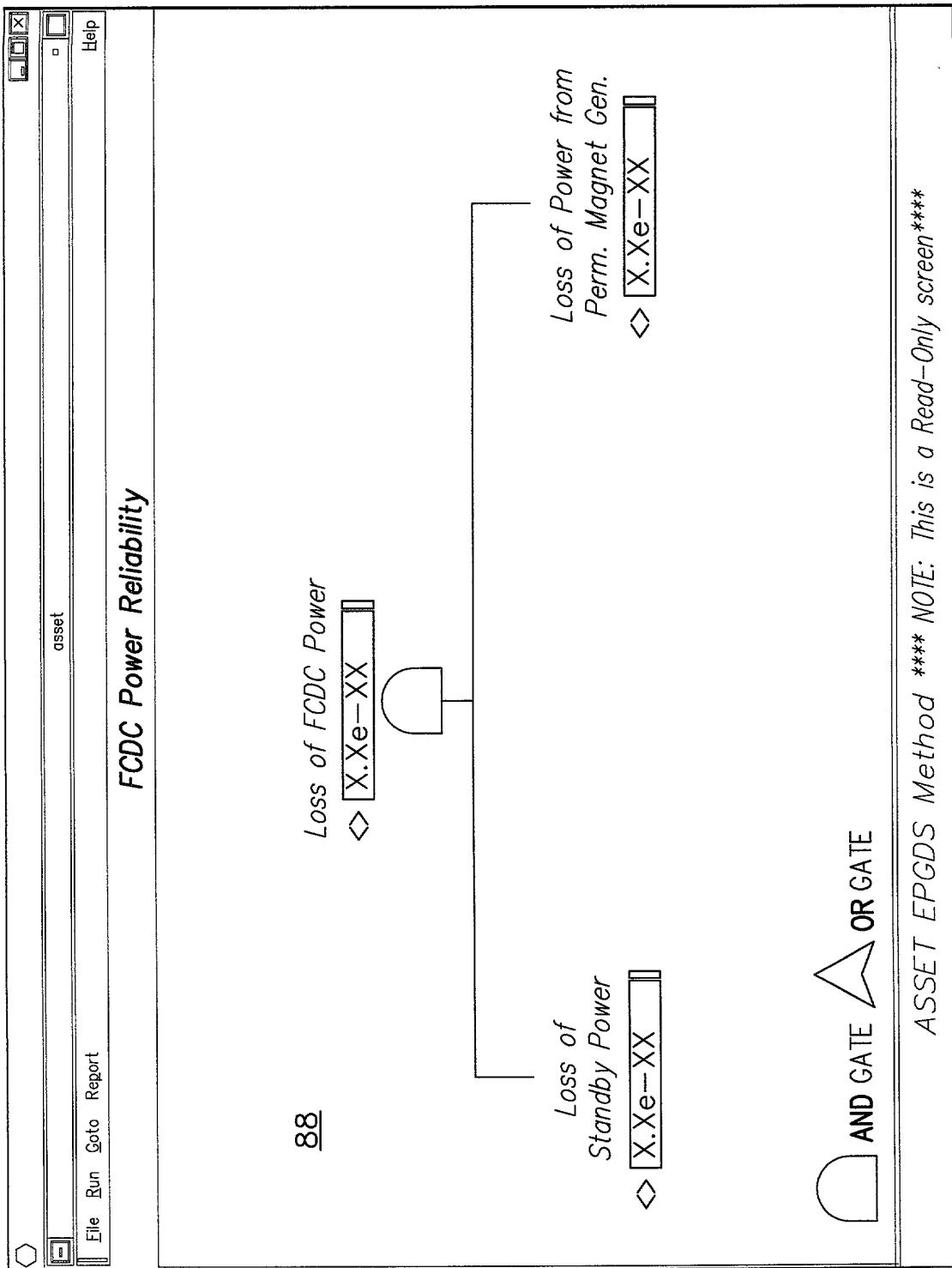


FIG. 50

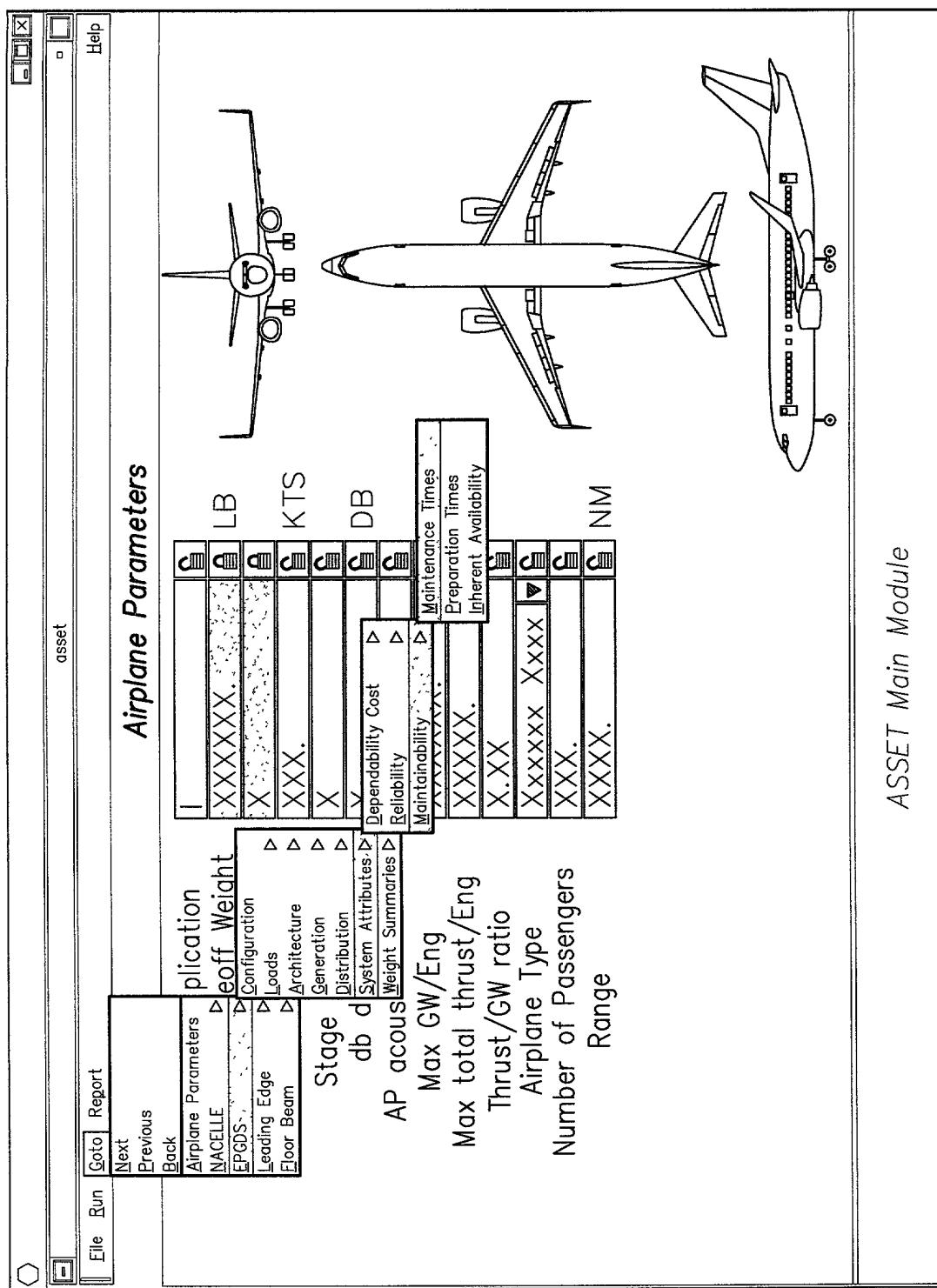
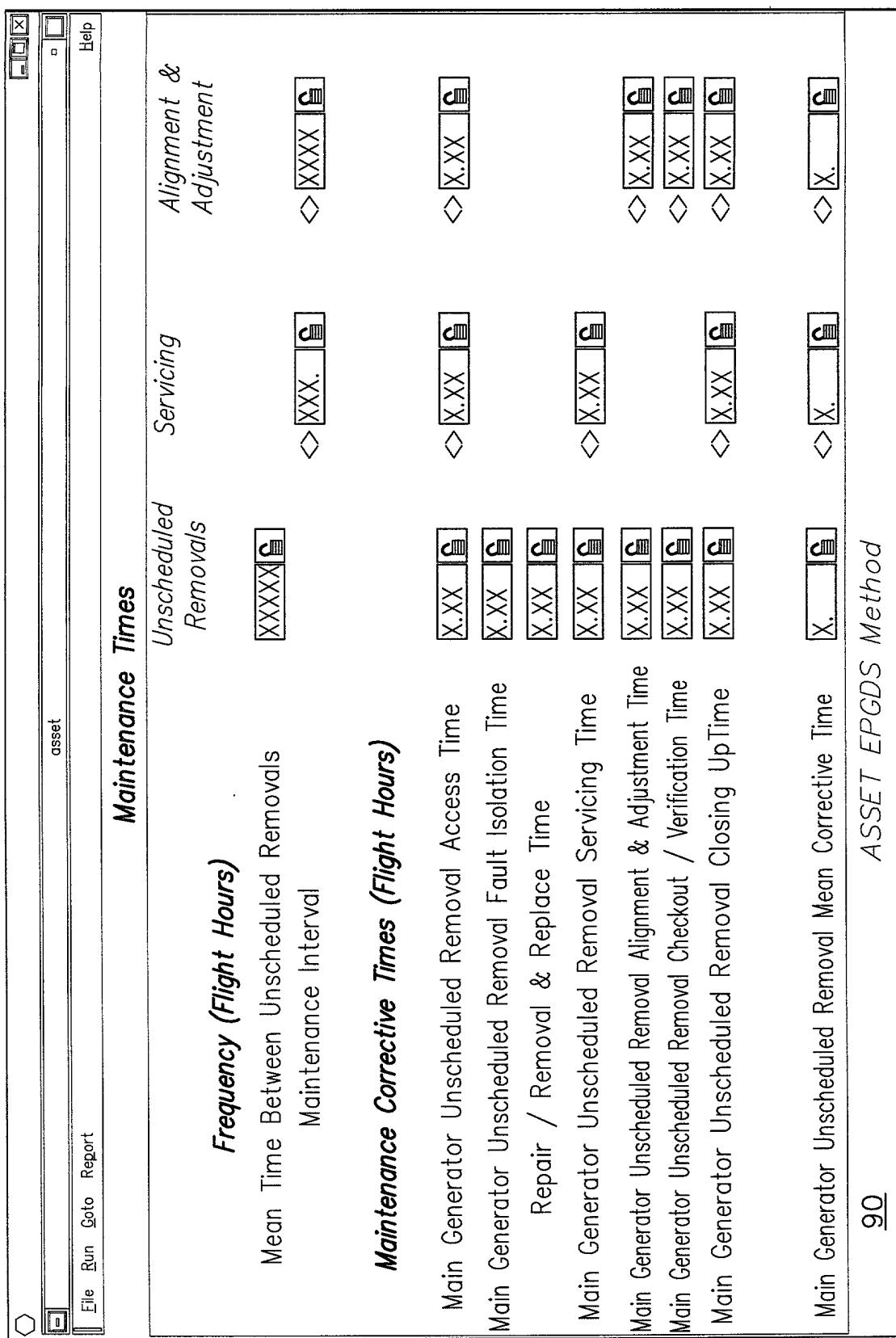


FIG. 51



The screenshot shows a software application window titled "ASSET EPGDS Method". The menu bar includes "File", "Run", "Goto", "Report", "Help", and a "Toolbox" icon. The main area displays maintenance times for a "Main Generator".

| Maintenance Times | | Unscheduled Removals | Servicing | Alignment & Adjustment |
|-----------------------------------------------------------------|----------|----------------------|------------|------------------------|
| Frequency (Flight Hours) | | | | |
| Mean Time Between Unscheduled Removals | X.XXX | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ |
| Maintenance Interval | | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ |
| Maintenance Corrective Times (Flight Hours) | | | | |
| Main Generator Unscheduled Removal Access Time | X.XX ┌ ┌ | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ |
| Main Generator Unscheduled Removal Fault Isolation Time | X.XX ┌ ┌ | | | |
| Repair / Removal & Replace Time | X.XX ┌ ┌ | | | |
| Main Generator Unscheduled Removal Servicing Time | X.XX ┌ ┌ | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ |
| Main Generator Unscheduled Removal Alignment & Adjustment Time | X.XX ┌ ┌ | | | |
| Main Generator Unscheduled Removal Checkout / Verification Time | X.XX ┌ ┌ | | | |
| Main Generator Unscheduled Removal Closing UpTime | X.XX ┌ ┌ | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ | ◇ X.XX ┌ ┌ |
| Main Generator Unscheduled Removal Mean Corrective Time | X. ┌ ┌ | ◇ X. ┌ ┌ | ◇ X. ┌ ┌ | ◇ X. ┌ ┌ |

At the bottom left is the page number "90" and at the bottom right is the caption "ASSET EPGDS Method".

FIG. 52

| Maintenance Preparation Times (Flight Hours) | | | |
|--------------------------------------------------------------------|----------------------|-----------|------------------------|
| | Unscheduled Removals | Servicing | Alignment & Adjustment |
| Main Generator Unscheduled Removal Maintenance Coordination Time | X.XX | <> X.XX | <> X.XX |
| Main Generator Unscheduled Removal Dispatch Delay Time | X.XX | | |
| Main Generator Unscheduled Removal Airplane Ferrying Time | X.XX | | |
| Main Generator Unscheduled Removal Supply Delay Time | X. | <> X.XX | <> X.XX |
| Main Generator Unscheduled Removal Spares & Equipment Issuing Time | X.XX | | <> X.XX |
| Main Generator Unscheduled Removal Transport Delay Time | X.XX | | |
| Main Generator Unscheduled Removal Maintenance Delay Time | X.XX | <> X.XX | <> X.XX |
| Main Generator Unscheduled Removal Maintenance Preparation Time | X. | <> X. | <> X. |

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

60/87

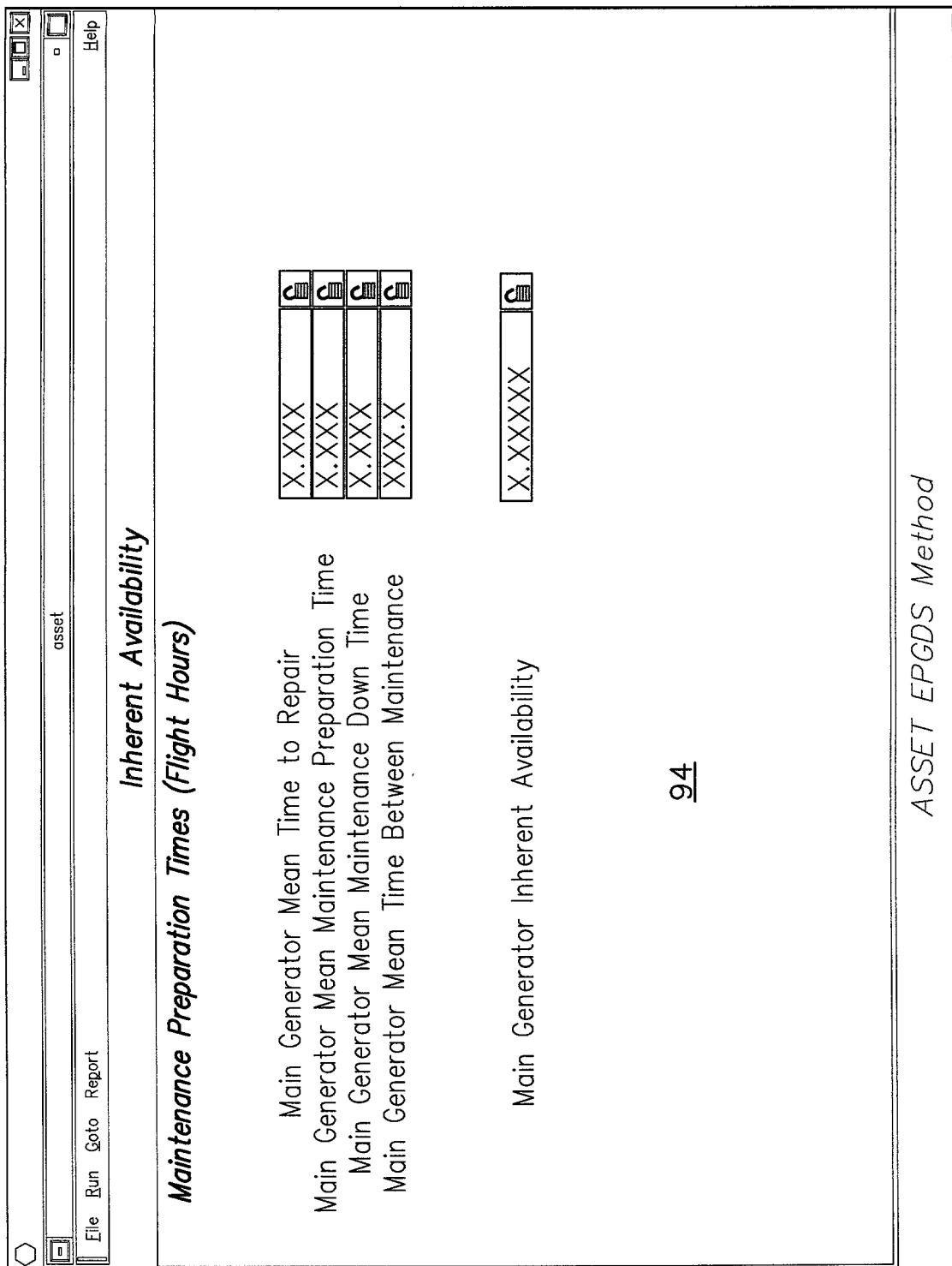


FIG. 54

The screenshot shows the ASSSET Main Module software interface. The title bar at the top includes standard icons for file operations (File, Run, Goto, Report, Next, Previous, Back) and system navigation (asset, Help). The main window is titled "Airplane Parameters". It features a large graphic of an airplane on the right side. On the left, there is a tree view of parameters categorized under "Application", "Weight", "Configuration", "Stage", "db", and "AP acous". Each category has several items listed, such as "NACELLE", "EPGDS", "Leading Edge", "Floor Beam", "Max GW/Eng", "Max total thrust/Eng", "Thrust/GW ratio", "Airplane Type", "Number of Passengers", and "Range". A detailed callout box highlights the "Weight" category, which contains "Weight Summaries", "EC 32 Weight Summary", "Below Wing Weight", and "ATA 24 Weight Summary". The "ATA 24 Weight Summary" box is expanded to show a hierarchical list of weight components: "24-09, Electrical Power Distribution", "24-10, Generator Drive", "24-21, Power and Regulation", "24-22, Controls and Indication", "24-25, Back-up Generator", "24-28, Feeders", "24-31, Batteries", "24-32, Transformer Rectifier", "24-33, Emergency Generator", "24-35, Flight-Contol DC Power", "24-40, External Power", "24-51, AC Power Distribution", "24-60, DC Power Distribution", "WW-01, Wiring Provision", and "ATA Chapter 24 Weight Totals". The bottom right corner of the interface displays the text "ASSSET Main Module".

FIG. 55

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

INVENTOR: BOND, et al.
SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

62/87

FIG. 56

63/87

FIG. 57

58
FIG.

65 / 87

FIG. 59

66/87

FIG. 60

FIG. 61

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

INVENTOR: BOND, et al
SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

68/87

FIG. 62

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

INVERNITI, BOND, et al.
SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

69 / 87

FIG. 63

FIG. 64

FIG. 65

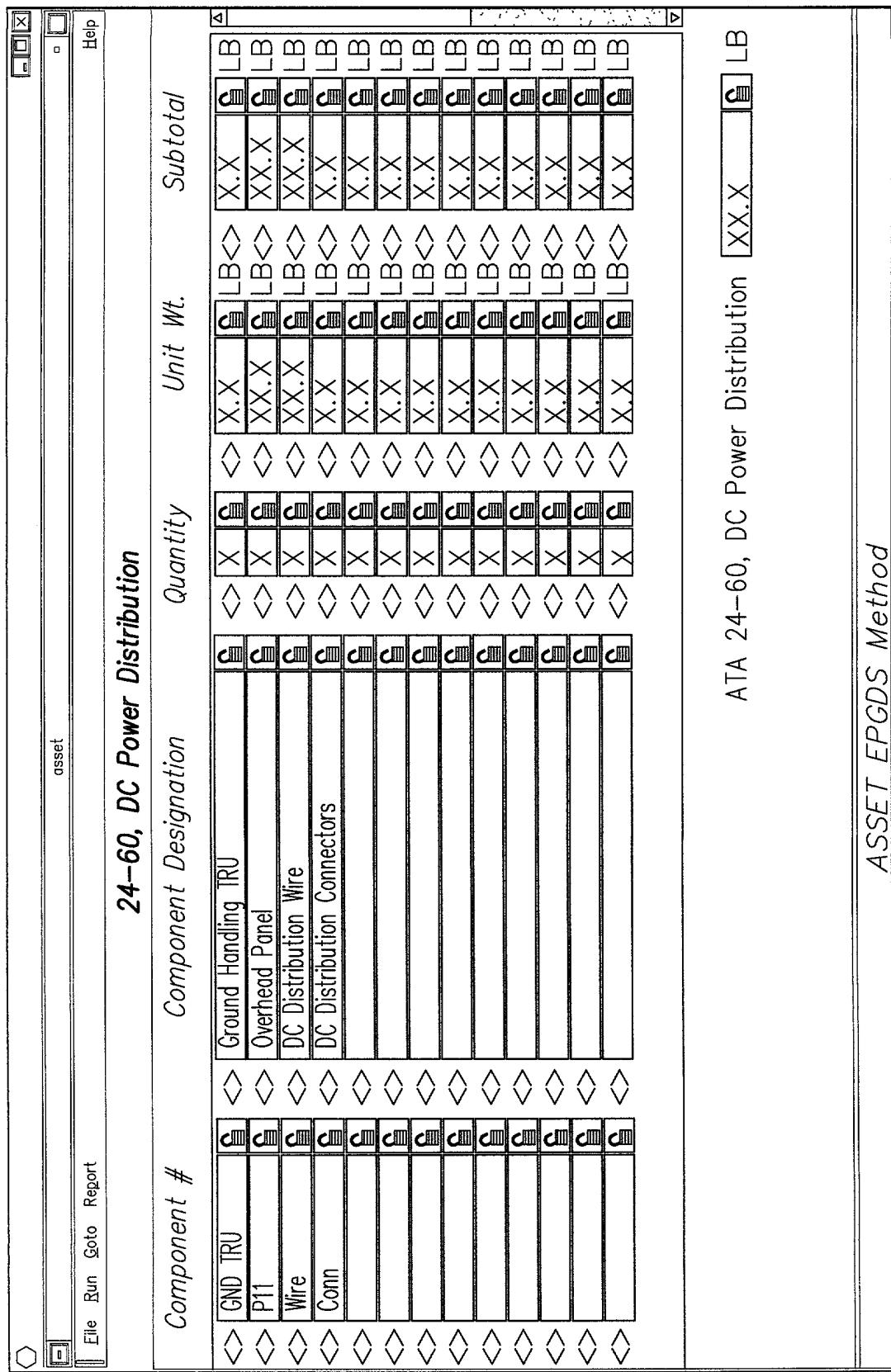
72/87

FIG. 66

73/87

FIG. 67

74/87



The screenshot shows a software application window titled "ASSET EPGDS Method". The main area displays a table titled "24-60, DC Power Distribution". The table has columns for "Component #", "Component Designation", "Quantity", "Unit Wt.", and "Subtotal". The "Component Designation" column lists items such as "Ground Handling TRU", "Overhead Panel", "DC Distribution Wire", "DC Distribution Connectors", "GND TRU", "P11", "Wire", and "Conn". The "Quantity" column contains mostly zeros, except for "Ground Handling TRU" which is 1, "Overhead Panel" which is 1, "DC Distribution Wire" which is 1, and "DC Distribution Connectors" which is 1. The "Unit Wt." column contains mostly zeros, except for "Ground Handling TRU" which is XX.X, "Overhead Panel" which is XX.X, "DC Distribution Wire" which is XX.X, and "DC Distribution Connectors" which is XX.X. The "Subtotal" column contains mostly zeros, except for "Ground Handling TRU" which is LB, "Overhead Panel" which is LB, "DC Distribution Wire" which is LB, and "DC Distribution Connectors" which is LB.

| Component # | Component Designation | Quantity | Unit Wt. | Subtotal |
|-------------|----------------------------|----------|----------|----------|
| <> | Ground Handling TRU | 1 | XX.X | LB |
| <> | Overhead Panel | 1 | XX.X | LB |
| <> | DC Distribution Wire | 1 | XX.X | LB |
| <> | DC Distribution Connectors | 1 | XX.X | LB |
| <> | GND TRU | | | |
| <> | P11 | | | |
| <> | Wire | | | |
| <> | Conn | | | |

FIG. 68

75 / 87

FIG. 69

76/87

The screenshot shows a software application window titled "ATA Chapter 24 Weight Totals". The menu bar includes "File", "Run", "Goto", "Report", and "Help". On the left, there's a toolbar with icons for "asset", "New", "Open", "Save", and "Print". The main area displays a table of weight data for various ATA chapters:

| | | |
|------------------------------------------|--------|----|
| ATA 24-09, Electrical Power Distribution | XXXX.X | LB |
| ATA 24-10, Generator Drive | XXXX.X | LB |
| ATA 24-21, Power and Regulation | XXXX.X | LB |
| ATA 24-22, Controls and Indication | XXX.X | LB |
| ATA 24-25, Back-up Generators | XXXX.X | LB |
| ATA 24-28, Feeders | XXXX.X | LB |
| ATA 24-31, Batteries | XXXX.X | LB |
| ATA 24-32, Transformer Rectifier | XXX.X | LB |
| ATA 24-33, Emergency Generator | XXXX.X | LB |
| ATA 24-35, Flight-Control DC Power | XXXX.X | LB |
| ATA 24-40, External Power | XXX.X | LB |
| ATA 24-51, AC Power Distribution | XXXX.X | LB |
| ATA 24-60, DC Power Distribution | XXX.X | LB |
| WW-01, Wiring Provision | XXXX.X | LB |

At the bottom right of the report area, it says "ASSET EPGDS Method". To the right of the report area, there's a vertical column with the text "Electrical Power Generation & Distribution System" followed by a large empty rectangular box containing a "LB" label.

FIG. 70

77/87

Airplane Parameters

The screenshot shows a software application window titled "ASSET Main Module". The menu bar includes "File", "Run", "Goto", "Report", "Next", "Previous", "Back", and "Help". A toolbar on the left contains icons for "File", "Run", "Goto", "Report", "Next", "Previous", "Back", and "Help". The main area displays "Airplane Parameters" with the following table:

| Parameter | Value |
|----------------------|------------------|
| Application | XXXXXX |
| eoff Weight | XXXXXX |
| Configuration | X |
| Loads | X |
| Architecture | X |
| Generation | X |
| Distribution | X |
| System Attributes | X |
| AP acous | Weight Summaries |
| Max GW/Eng | XXXXXX |
| Max total thrust/Eng | XXXXXX |
| Thrust/GW ratio | X.XX |
| Airplane Type | XXXXXX |
| Number of Passengers | X.XX |
| Range | XXXXXX |

Below the table, there is a "Weight Summary" section with the following table:

| Element | Weight |
|------------------------|-----------------------------------------------------|
| EC 32, Weight Elements | FC 32-01, AC Power System |
| | FC 32-02, DC Power System |
| | FC 32-03, Airframe Lighting |
| | FC 32-04, Electrical Equipment and Supports |
| | FC 32-05, Indication & Misc. Elec. Systems |
| | FC 32-06, Cargo Panels |
| | FC 32-07, Pwr Phi-W/B Assy/Hldg Tank |
| | FC 32-08, Elec Load Mgmt Sys (ELMS) |
| | FC 32-10, Electrical Sys. Cntrl/Indication |
| | FC 32-23, ARINC 629-Cardfies, BPCU, GCU, FSCF, ELMS |
| | FC 32-92, Eng/Strut Wiring Instl/Airplane |
| | FC 32-95, HIRF Protection-Electrical |
| | FC 32-97, EBU Wire Bundle Assemblies |

To the right of the table, there is a schematic diagram of an aircraft main module. The diagram shows a cross-section of the aircraft with various components labeled: LB (Landing Gear), KTS (Knee Thrust Strut), DB (Dome Beam), and EC 32 Weight Elements. A legend indicates that the symbols represent different types of elements.

FIG. 71

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS
INVENTOR: BOND, et al.
SN: 09/900,522; FILED 7/6/01
ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

78/87

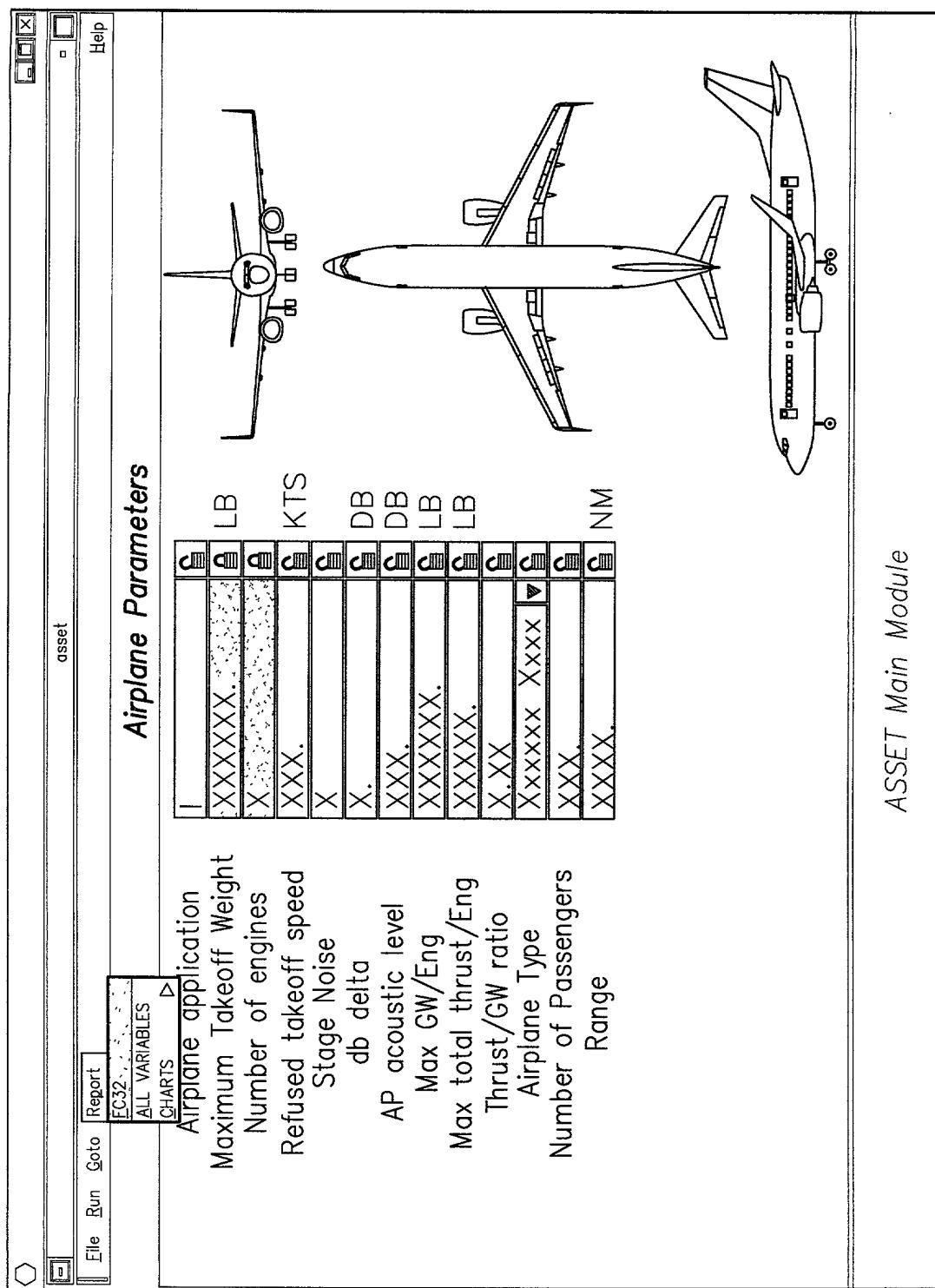


FIG. 72

79 / 87

Offset

Help

File Run Goto Report

Airplane Parameters

Airplane application ASSET: Report

Maximum Takeoff Weight LB

Component # Component Designation Qty Unit Wt (LB)

| Component # | Component Designation | Qty | Unit | Wt (LB) |
|----------------|---------------------------------------------------|-----|-------|---------|
| 32 | Electrical Power Generation & Distribution System | | | |
| 32-01 | AC Power System | X | XXX.X | |
| 32-01-01 | AC POWER GENERATION EQUIPMENT | X | XXX.X | |
| 32-01-01-01 | MAIN AC POWER GENERATORS INSTLD | X | XXX.X | |
| 32-01-01-01-01 | PRIME DRIVE GENERATOR | X | XXX.X | |
| 32-01-01-01-02 | QUICK ATTACH DETACH (QAD) | X | XX.X | |
| 32-01-01-01-03 | GENERATOR FLUIDS | X | XX.X | |
| 32-01-01-01-05 | HARDWARE INSTALLATION | X | XX.X | |
| 32-01-01-01-06 | WIRING INSTALLATION | X | XX.X | |
| 32-01-01-02 | GENERATOR CONTROL UNITS | X | XX.X | |
| 32-01-01-06 | BUS POWER CONTROL UNITS | X | XX.X | |
| 32-01-05 | EROPS-VSCF POWER GENERATION SYSTEM | X | XXX.X | |
| 32-01-05-01 | VSCF GENERATORS & OIL | X | XXX.X | |
| 32-01-05-01-01 | VSCF GENERATOR | X | XXX.X | |
| 32-01-05-01-02 | VSCF GENERATOR OIL | X | XX.X | |

Return

send to printer

save to file

ASSET Main Module

FIG. 73

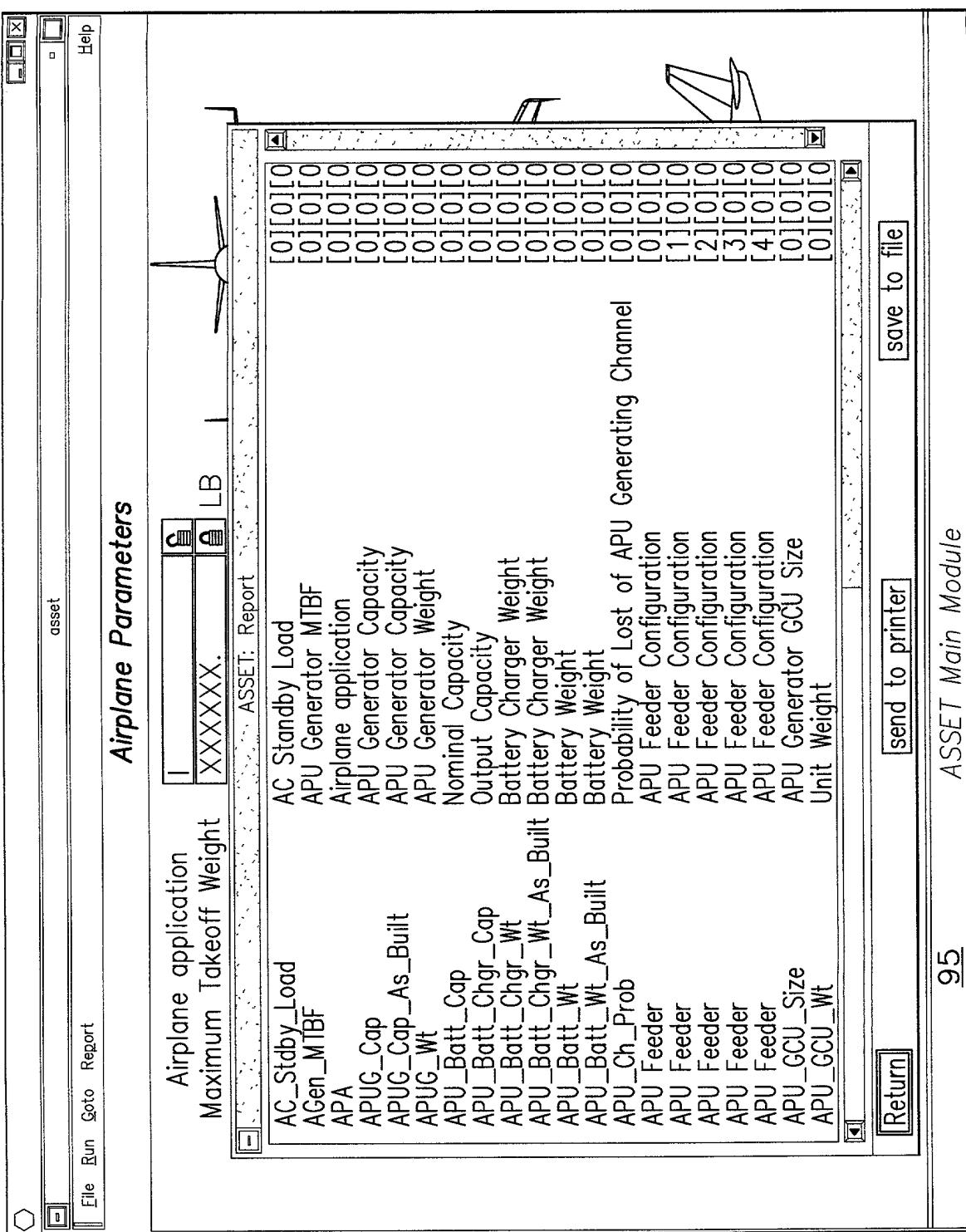


FIG. 74

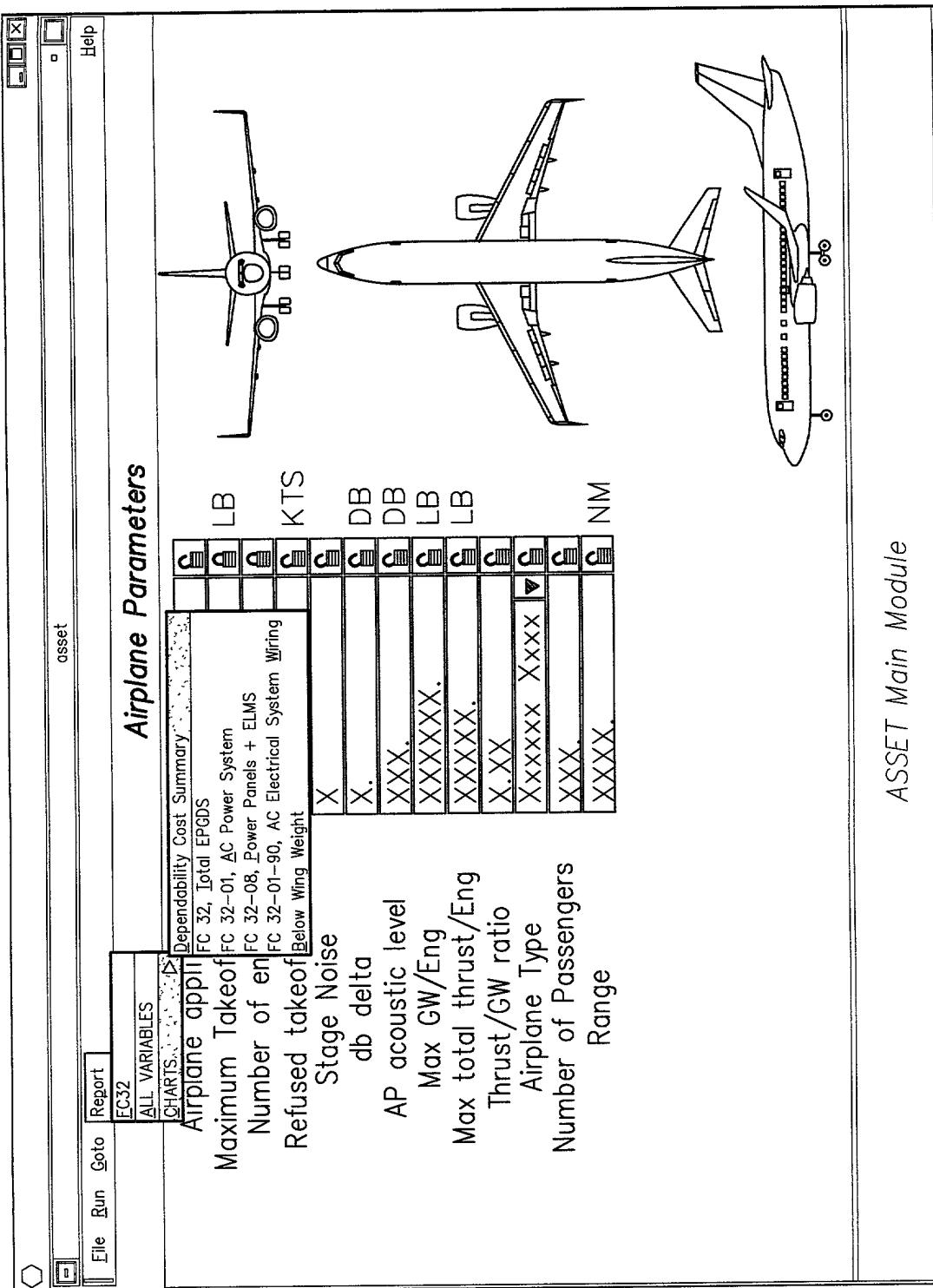


FIG. 75

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

82/87

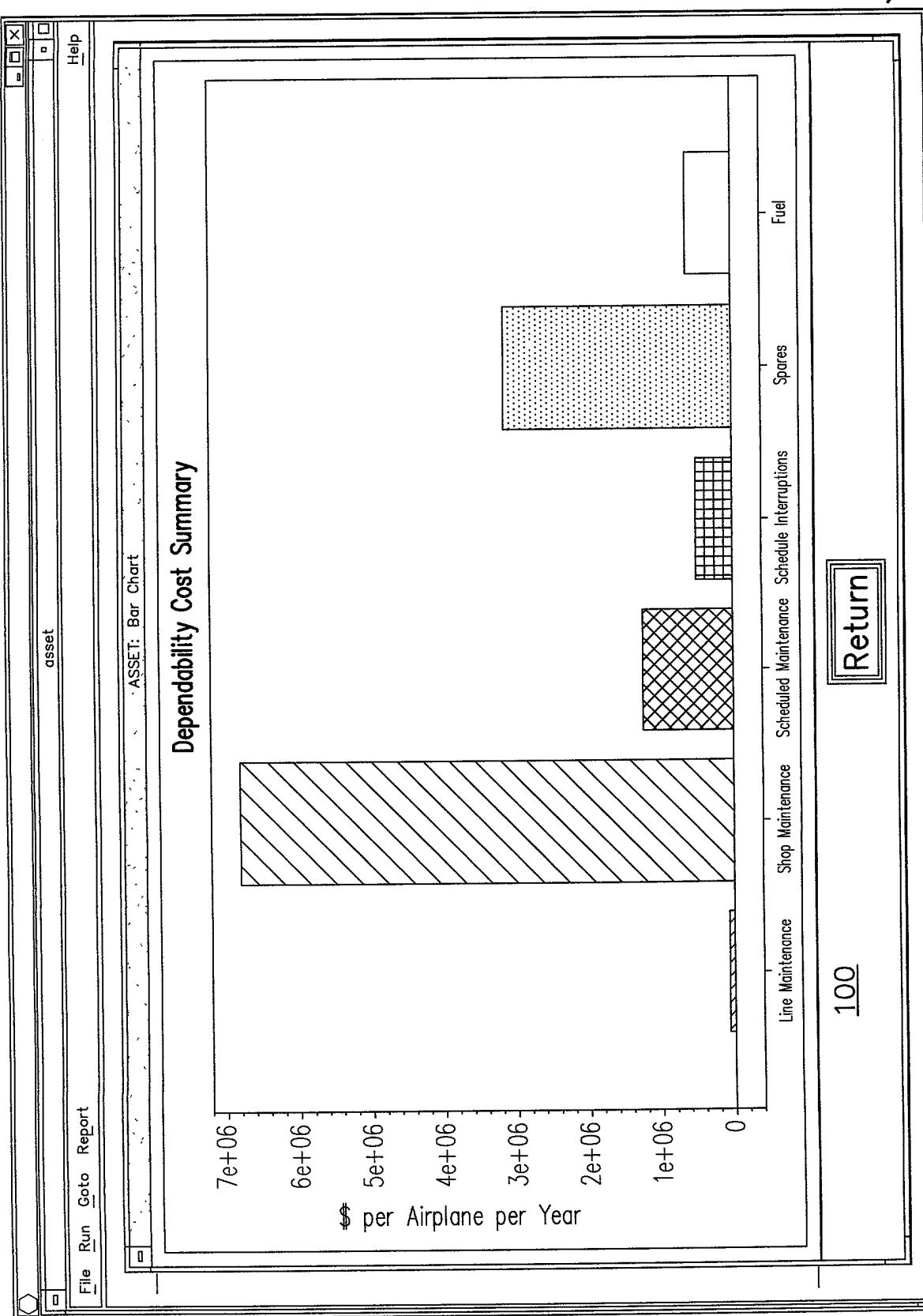


FIG. 76

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

83/87

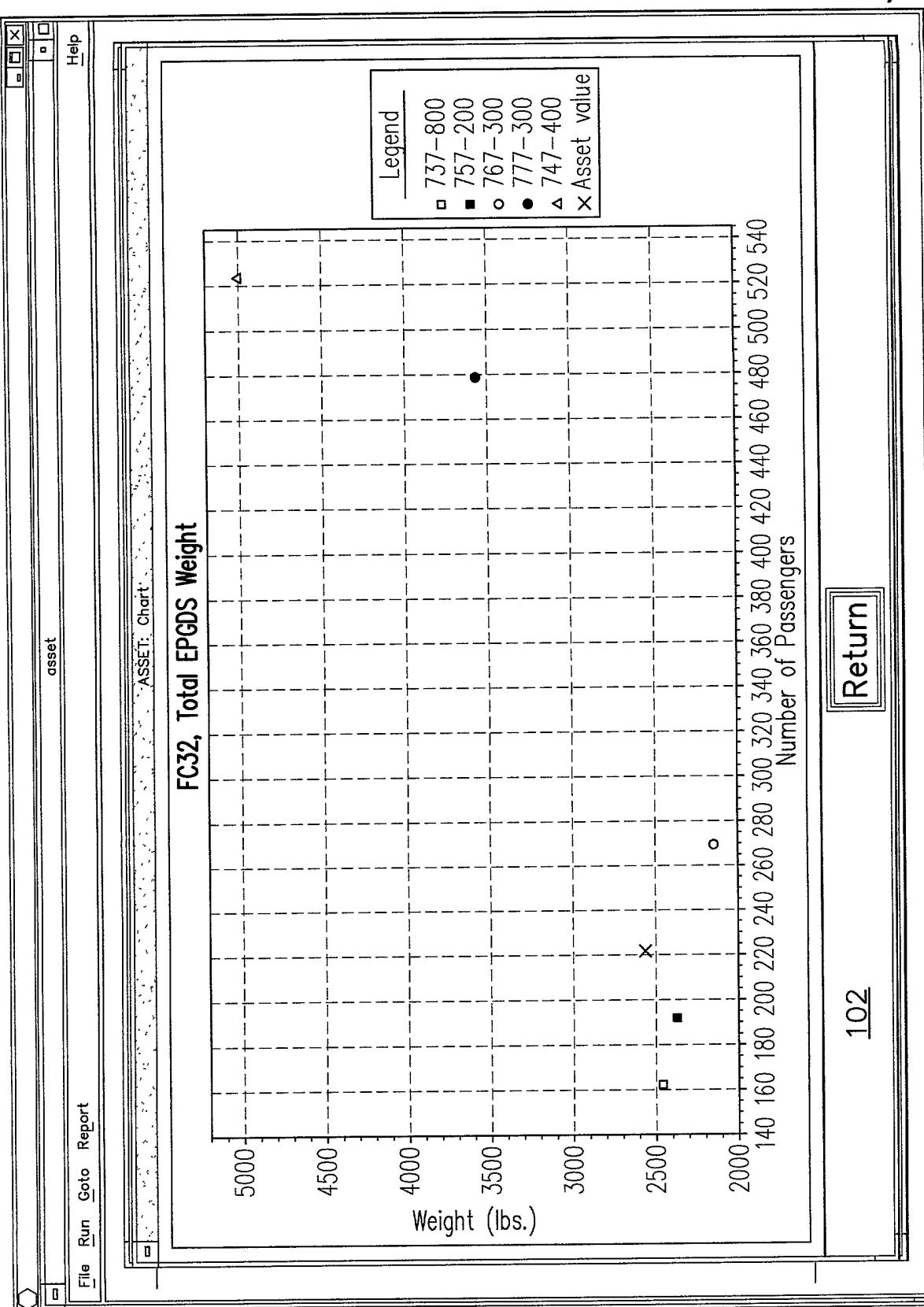


FIG. 77

TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

84/87

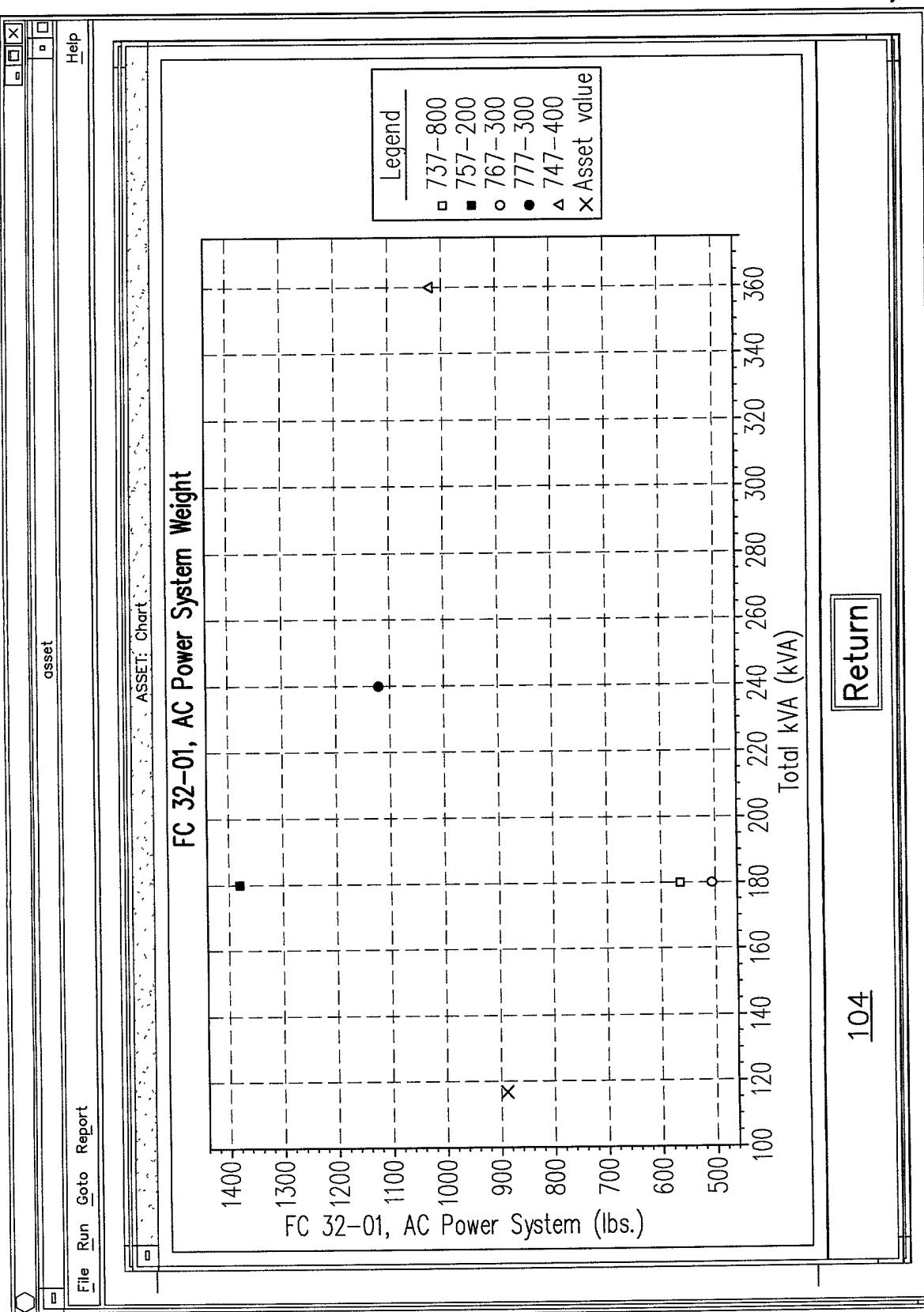


FIG. 78

85/87

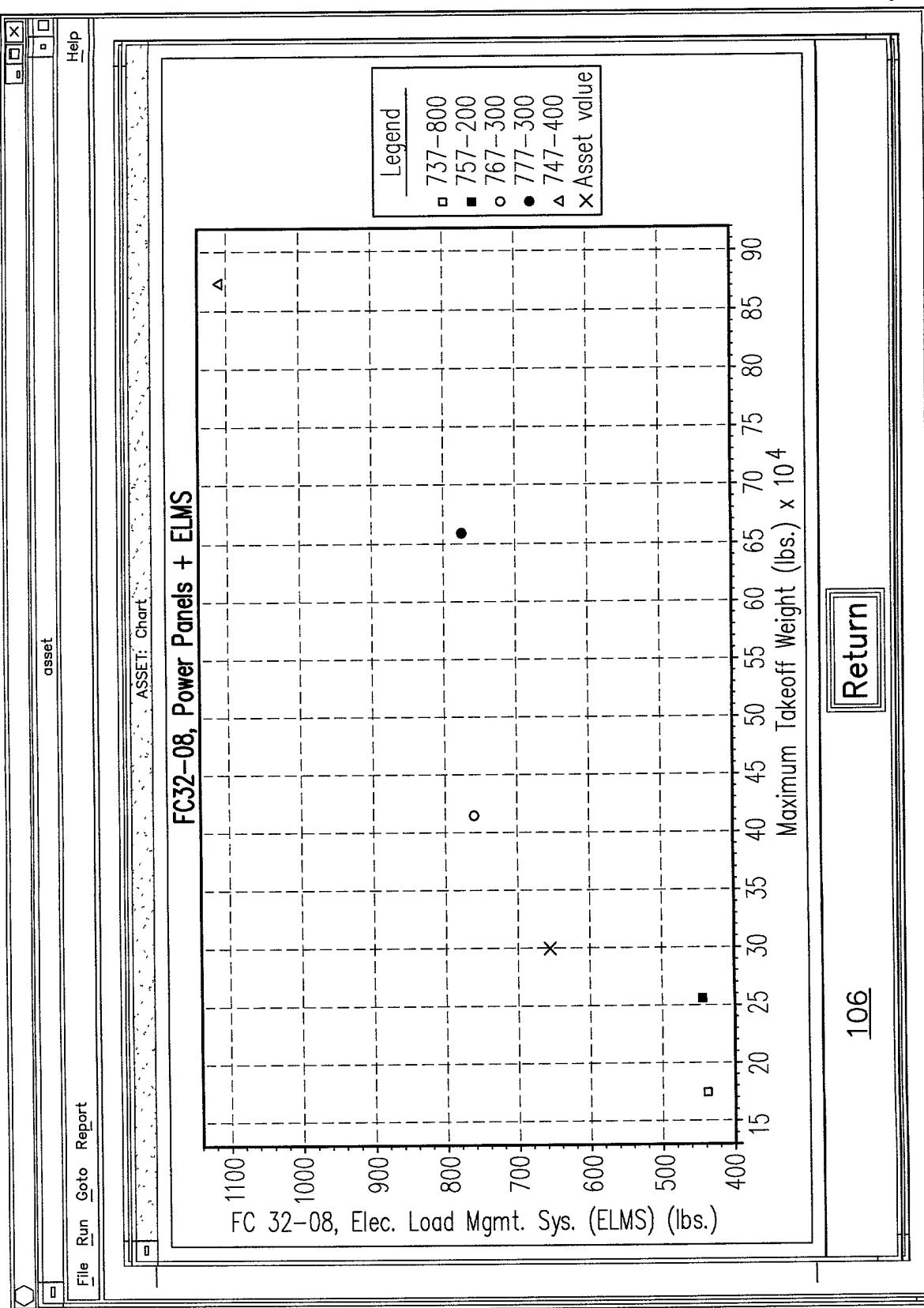


FIG. 79

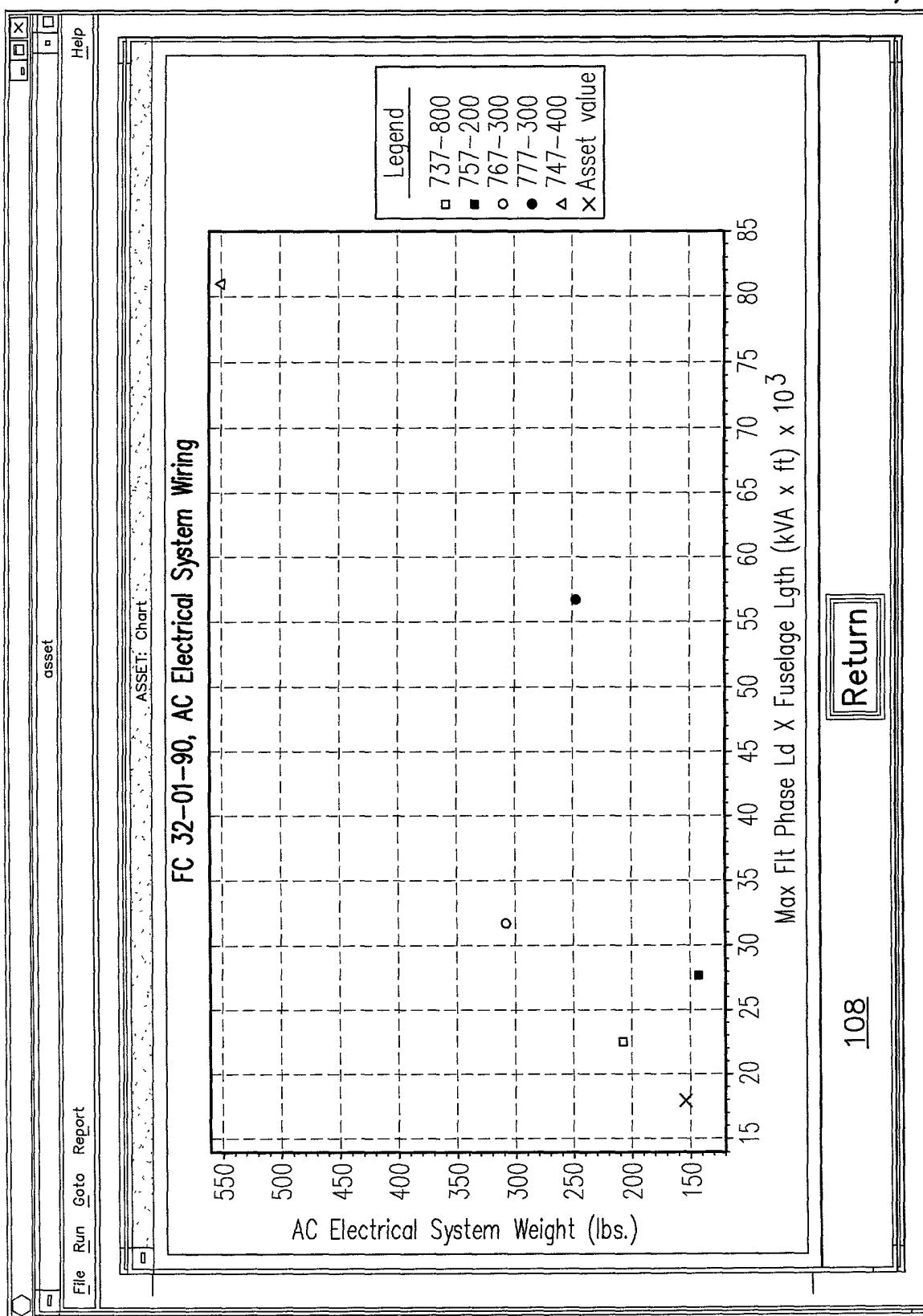
TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

86/87



TITLE: AIRCRAFT SYNTHESIS AND SYSTEMS EVALUATION METHOD FOR DETERMINING AND
EVALUATING ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEM COMPONENTS

INVENTOR: BOND, et al.

SN: 09/900,522; FILED 7/6/01

ATTY: MARK D. ELCHUK; PHONE: (248) 641-1229

87/87

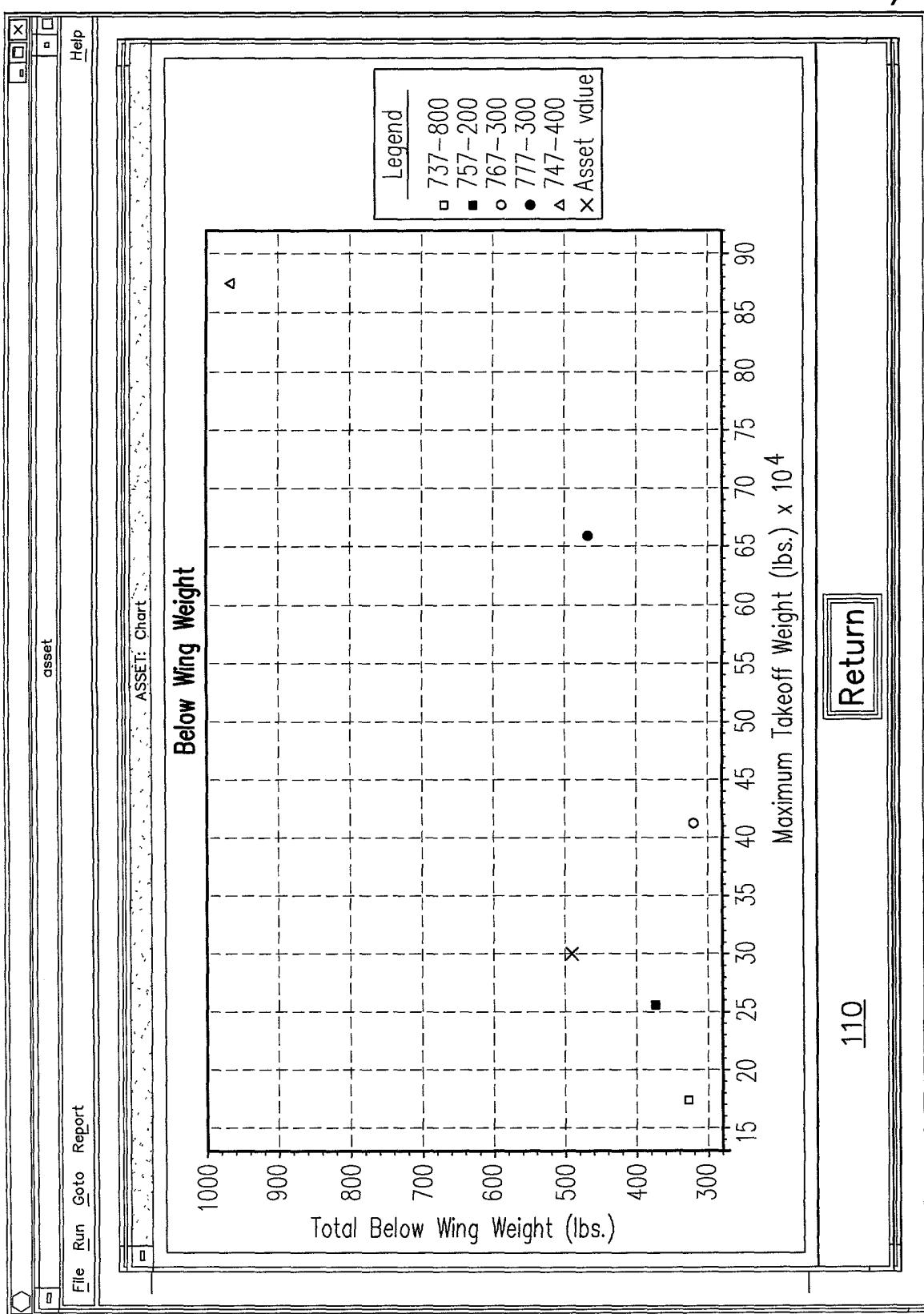


FIG. 81